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SEMI-ANNUAL REPORT NO. 11

IPD-310-11

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* Project *

* NICRAD-85-NADC-008 *

* "THE APPLICABILITY OF *

* PATENTED TECHNOLOGIES *

* TO *

* SONOBUOYS" (U) *

* * * * *

Prepared For:

DEPARTMENT OF THE NAVY

Naval Air Development Center

Planning, Assessment, Resources
(Code 01B)

and

Acoustics Development Division
(Code 504)

Warminster, PA 18974

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SEP 02 1988
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INTELLECTUAL PROPERTY DYNAMICS

612 Bridle Road
Glenside, PA 19038

(215) 572-0400

30 June 1988

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19 ABSTRACT (Continue on reverse if necessary and identify by block number) <p>NADC has the responsibility for executing and sponsoring R&D projects to build on the Navy's Technology base for improved ASW systems.</p> <p>The objective of project NICRAD-85-NADC-008 is to provide information to support NADC's planning and management of future Sonobuoy development and acquisition programs. IPD tabulates Navy Requirements and conducts a computerized search, analysis, and evaluation of U.S. patented inventions which offer promise towards improving the design of future Sonobuoys.</p> <p>IPD contacts the owners of the selected inventions to determine the current status of the invention, and the owners' suggested path to its implementation in terms of Navy Requirements.</p>					
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FOREWORD

* * * * *

This Semi-Annual Report, prepared by Intellectual Property Dynamics (IPD), provides a snapshot of IPD's effort performed from 01 January to 30 June 1988, and presents the total project results to date.

This is the eleventh IPD Report under Project NICRAD-83-NADC-001, dated 18 January 1983, and continued under NICRAD-85-NADC-008, dated 18 January 1986.

Plans for IPD's effort under Project NICRAD-85-NADC-008 during the next Semi-Annual Report Period are also included.

The central objective of this NICRAD project is to provide information to aid NADC in the planning and control of its Sonobuoy development and acquisition management programs. The Acoustics Development Division of NADC has the responsibility for sponsoring and executing programs, which are comprised of numerous research and development tasks to provide an important segment of the technological base for future airborne ASW systems.

Specifically, Project NICRAD-85-NADC-008 comprises a computer-assisted search and analysis of patent documents issued by the U.S. Patent and Trademark Office, and includes PCT Patent Applications published by the World Intellectual Property Organization. The goal is to select, examine, and rank those patented inventions which could enhance the cost-effectiveness of future Sonobuoy designs.

IPD contacts the inventor/owners of the "most likely candidates" to ascertain the current development status of the invention, the owner's suggested path to its implementation, and interest (as a source) to advance the technology to the point of meeting Navy Requirements.

Copies of the cover page of the "Most relevant" patents are included beginning on Page 43 of this Report.

A - PROGRESS (Item 25 of DD Form 1498)
01 January - 30 June 1988

1. The thirty-nine (39) U.S. patents selected as "Most applicable" to future Sonobuoy designs were reexamined.
2. Contacts with twenty-eight (28) attorneys-of-record have been initiated, to date, for acquiring status information for each of the thirty-nine (39) patented inventions selected as "Most applicable".

3. IPD has selected sixteen (16) potential R & D sources.
4. IPD's development of an automated procedure for correlating U.S. Patent Office Classes with National Stock Classes (NSN) is now about 70% complete.
5. Total IPD man-hours to date = 796.0
6. Total IPD mainframe computer costs to date = \$4,250.00.

B - NEXT SIX-MONTH REPORT PLANS

1. Contacts will be made with the remaining attorneys-of-record for each of the thirty-nine (39) patented inventions listed in SECTION VII hereof to determine current status, amount of further development needed, and availability of the patented technology for Sonobuoy applications. "Thank you" notes will be sent to the respondents.
2. All patents listed herein will be re-evaluated and ranked according to the latest NADC Requirements known to IPD.
3. The most recent patented inventions issued in each functional category will also be evaluated in terms of published Sonobuoy design Requirements.

C - RECOMMENDATIONS

The following sixteen (16) assignees should be considered by NADC, thus far, as "new" sources for R&D on advanced Sonobuoy technologies:

1. Anatel Instrument Corp. (Previously PureCycle Corp.)
2200 Central Ave, Boulder, CO 80301
2. Compagnie Generale de Geophysique
6 Rue Galvani Paris, France
3. EIC Laboratories, Incorporated
Newton, MA 02146
4. Edo Western Corporation
2645 South 300 West, Salt Lake City, UT 84115

RECOMMENDATIONS - (Continued)

5. Federal Screw Works
3401 Martin Avenue, Detroit, MI 48210
6. Fujitsu, Limited
Marunouchi 2-Chome, Tokyo, 100, Japan
7. Laland Stanford University,
Stanford, CA 94305
8. Matsushita Electric Industrial Company
1006 Oaza Kadoma Osaka, 571, Japan
9. Nippon Electric Company, Limited
Minato-ku, Tokyo, 108, Japan
10. Occidental Chemical Corporation
River Park, Darian, CT 06820
11. Refraction Technology, Inc.
2526 Mananna Drive, Dallas, TX 75220
12. Siemens AG
186 Wood Avenue South, Iselin, NJ 08830
13. Sunstrand Data Control, Incorporated
4751 Harrison Avenue, Rockford, IL 61101
14. Thompson-CSF,
23 Rue De Courcellas, Paris, France
15. Toyo Communications Equipment, Ltd.
7-2 Sagisu 5-Chome, Osaka, 533, Japan
16. Victor Company of Japan
Chuo-Hu, Tokyo, 103, Japan



IPD would gratefully appreciate receiving comments or suggestions from the Navy regarding the contents and utility of this report series.

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Unannounced	<input type="checkbox"/>
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I - INTRODUCTION

Patent literature is a rich and often under-utilized source of technological information which may never be published. Over 1.2 million unexpired U.S. patents exist today, with about 70,000 new patents issued each year. Ten or more U.S. patents are owned by the 8,000 foreign and domestic corporations, universities, Government agencies, private organizations, and individuals.

The basic premise of the work reported on herein is:

1. The Navy needs Intellectual Property Rights to support the management of its on-going Sonobuoy development programs.
2. Over 1.2 million unexpired U.S. patented inventions exist today of which over 500,000 are foreign owned.
3. Many new and useful ideas (and their sources), which could meet specified Navy Requirements, are being selected, examined, and evaluated by IPD through an orderly process.

As presented in FIGURE 1, IPD's analysis begins with a tabulation of Navy Requirements for the design of next generation Sonobuoys posted in NARDIC. The analysis is augmented by data obtained through personal contact with key members of the Acoustics Development Division staff at NADC, whom have cited current Sonobuoy problem areas that require early improvement. See FIGURE 1 (1).

The second step comprises an on-line computer search and evaluation of recently patented inventions (down to the components level) that appear to offer the greatest potential for improving the performance (while reducing the cost) of future Sonobuoys, and which support the tabulated Requirements. See FIGURE 1 (2).

Finally, Recommendations are submitted to NADC for Sonobuoy design improvements with a list of new potential R & D sources.

The search is conducted within the following set of constraints:

A. AUTOMATICALLY ELIMINATED

- All U.S. patented inventions issued prior to 01 January 1977 (under No. 4,000,000).
 - We are looking for NEW ideas - - NOT infringements.
- All patented inventions assigned to U.S. Government agencies
 - We are looking for NEW ideas that may exist in privately-held domestic and foreign-owned portfolios.

Intellectual Property Targeting
An Integrated Systems Approach

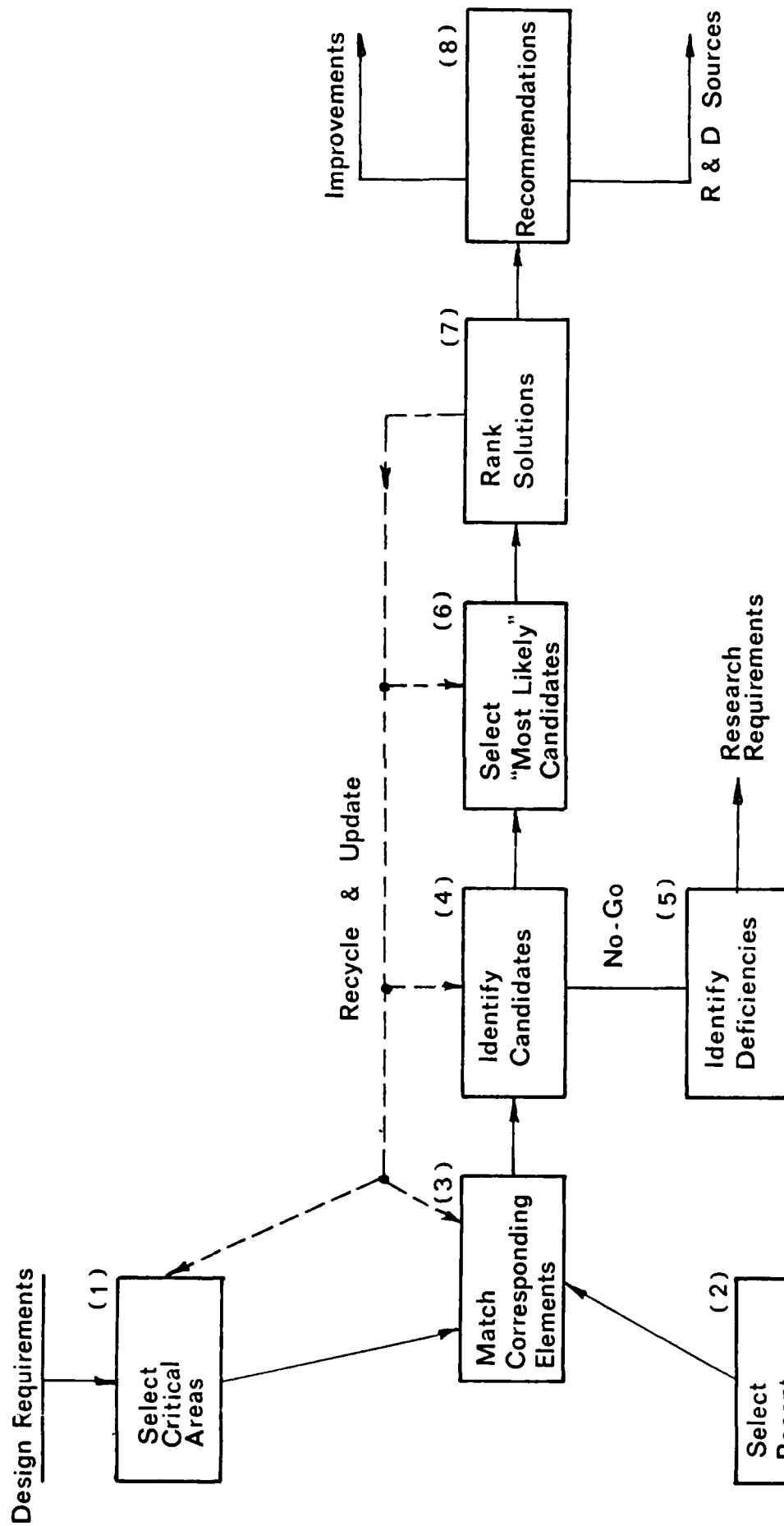


FIGURE 1



INTELLECTUAL
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B. MATCH THE CORRESPONDING ELEMENTS - See FIGURE 1 (3)

- Private inventions are selected, which appear to offer the greatest potential cost-benefits in the design of future Sonobuoys.

More than one-hundred (100) Navy owned patented inventions, which relate to Sonobuoy functions, are not included.

In searching for recent patented inventions, IPD uses the on-line "CLAIMS/U.S. Patents" databases, owned by IFI/Plenum Corporation, and Pergamon Orbit InfoLine, Inc. These databases each contain approximately 1.2 million records of U.S. patents issued since 1971, and some 1,400 new records are added weekly to each database. In addition, utility patents, issued by the U.S. Patent and Trademark Office (USPTO) and published by the World Intellectual Property Organization in all areas of technology from 01 January 1971 to date, are also considered with information about the activity, owner(s), and national origin of patented inventions. The databases are readily accessed using the following search criteria:

- Keywords contained in the title or abstract
- PTO classifications (over 400 Classes and 100,000 Sub-classes)
- Patent issue date
- Inventor and Assignee name(s).

Referring to the Systems Approach as shown in FIGURE 1, IPD's effort utilizes the following logical steps, which are periodically updated:

- (4) Identify candidates;
- (6) Select most likely candidates;
- (7) Rank the candidates (None, Marginal, Moderate, Most), in terms of the tabulated Requirements; and
- (8) submit Recommendations to NADC.

IPD bases its approach on an iterative process (series of successive approximations), which lead to the final step, FIGURE 1 (8) RECOMMENDATIONS - for potential improvements in Sonobuoy design, and which lists "new" private sector R&D sources that have a demonstrated capability. Each re-cycle and update, or "cut" at the search, allows an improved definition of the interrelationship sensitivities between Navy Requirements and potential source capabilities.

Copies of the "most relevant" privately-owned inventions are examined and posted in SECTION V hereof.

An important element in the IPD effort is the development of new methodologies for improving the effectiveness of the analysis and evaluation process. An example is a viable means for correlating Federal Stock Class (FSC) System classifications with the applicable U.S. Patent and Trademark Office (USPTO) Technology Classifications. (See SECTION V hereof).

II - WORK PERFORMED

* * * * *

(01 January 1988 - 30 June 1988)

During the 01 January to 30 June 1988 Semi-annual Report period, IPD's effort included a re-examination of the applicability of the thirty-nine (39) U.S. patented inventions selected to date, together with contacting the cited attorney-of-record. (See SECTION VII, starting on page 22 of this report)

No additional patented candidates were selected during this report period.

The forty-six (46) key USPTO Classes and their relevance to future Sonobuoy designs are listed in SECTION IV hereof, and will be used to support the further development of a computer-assisted technique for correlating U.S. Patent Office classes (and sub-classes) with the applicable National Supply Classifications (NSNs).

III - CONCLUSIONS

* * * * *

1 July 1987 - 31 December 1987

The thirty-nine (39) "Most" applicable U.S. patents are:

4,017,903	4,185,143	4,186,370
4,189,690	4,208,737	4,213,195
4,245,332	4,280,202	4,295,211
4,300,813	4,309,763	4,313,185
4,315,325	4,326,275	4,346,476
4,359,767	4,364,117	4,365,320
4,383,831	4,388,384	4,400,805
4,407,907	4,419,657	4,421,384
4,426,712	4,449,210	4,474,685
4,495,546	4,513,353	4,531,095
4,542,076	4,554,510	4,591,802
WO 81-03734	WO 81-00942	WO 82-04365
WO 86-03077	WO 86-03337	WO 87-03163

The cover page for each of the above patents is presented in FIGURE 4 of this report.

The Attorneys-of-record contacted have been most cooperative in supplying IPD with the requested invention status and availability information. (see SECTION VIII hereof)

IV - FRAME OF REFERENCE

* * * * *

Sonobuoy Architecture

A. Statement of Functions

The overall function of a Sonobuoy is to sense and translate acoustic, (and/or other undersea data), and to transfer such data, via a suitable communication link, to a receiver located above the air/sea interface. The undersea sensing mode can be active or passive.

Sonobuoys are used to detect, classify, determine direction of movement, and report on surface vessel activity. Moreover, Sonobuoys can also intercept and record time and signature data from aerospace radiating sources during overflights of the operating area. Such data would be available later on command via the Sonobuoy RF uplink.

Oil prospectors use hard-wired "Sonobuoys" dipped in well holes.

The primary non-acoustic sensors include Magnetic Anomaly, Infrared detection, ELINT, Sea Thermal Gradients (Bathythermograph), and Electronic Countermeasures data for the Advanced Sonobuoy Communications Link (AN/ALQ-168 and AN/ARR-78).

Although most of the Navy's Sonobuoys currently use only 31 VHF channels, they are being replaced by 99 channel units. For instance, the AN/UYS-1 can process both analog and digital Sonobuoy transmissions.

To enable an analysis of the applicability of patented inventions, the interrelationship of Sonobuoy functions has been compartmentalized into a hierarchy of functional subsets as shown in FIGURE 2. Each functional subset is analyzed independently, and patented invention candidates are selected and evaluated according to their applicability to each subset.

FIGURE 3 presents Sonobuoy input/output functions, as well as Sonobuoy functions at the modular level and their interrelationships.

IPD's approach systematically breaks the problem down into manageable segments, which are then amenable to analysis and evaluation.

SONOBUOY — Functional Block Diagram

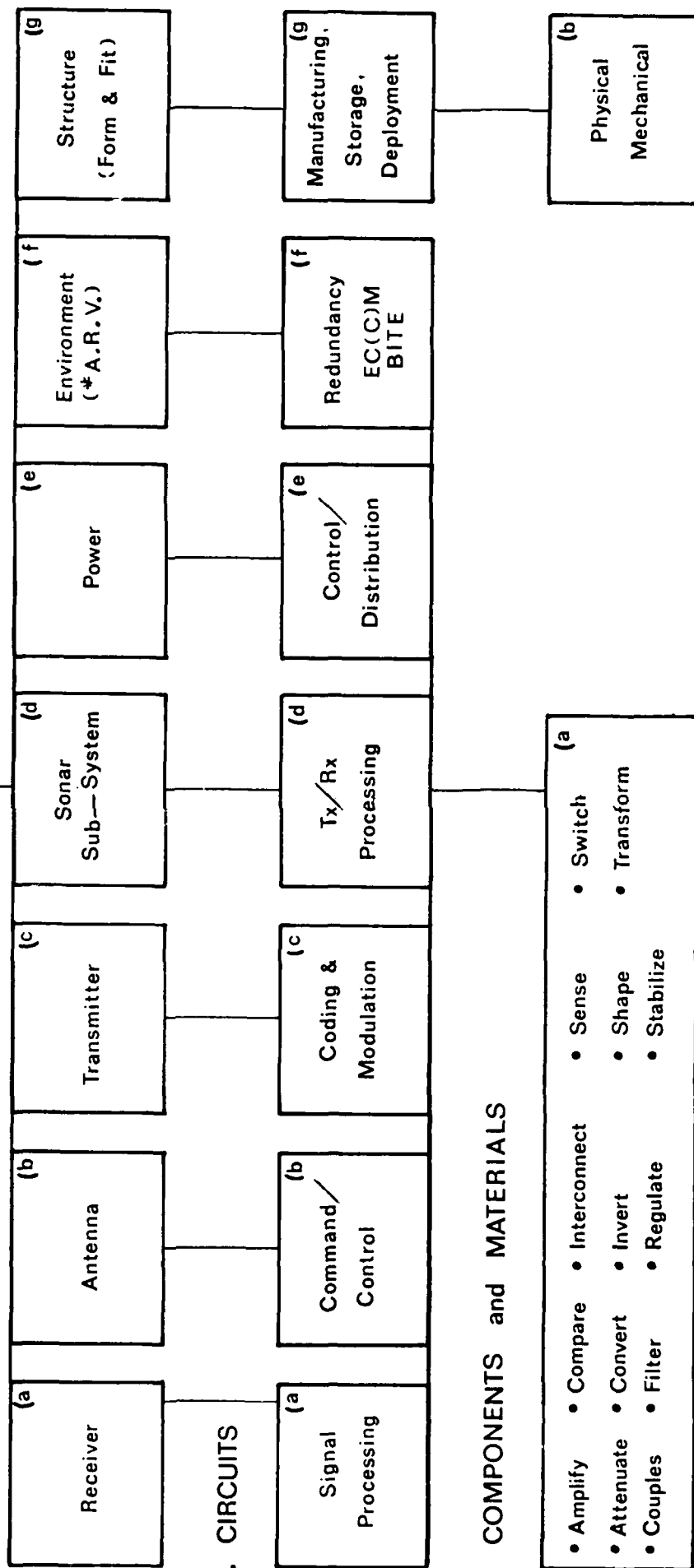
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1. OVERALL SYSTEM

AN/SSQ—

2. MODULES



4. COMPONENTS and MATERIALS

- Amplify
- Attenuate
- Couples
- Compare
- Convert
- Filter
- Interconnect
- Invert
- Regulate
- Sense
- Shape
- Stabilize
- Switch
- Transform

* Availability, Reliability, Vulnerability and Position Locating

FIGURE 2

SONOBUOY - Basic Modular Functions

MODULE	INPUT	FUNCTION	OUTPUT
a) Receiver	Modulated VHF Command/ Control Signal, and Noise.	Selects/converts RF Signal to Baseband and consumes Power.	Baseband Control Signals.
b) Antenna	VHF Signals & Noise.	Couples EM Waves to VHF Receiver/transmitter.	RF Signals.
b) Transmitter	Baseband Data.	Generates, amplifies, modulates RF carrier, and consumes Power.	VHF RF Carrier.
d) Sonar*	Command Data.	(*Transmits undersea pulses) receives data, and consumes Power.	Range/bearing Baseband Data.
e) Power Conversion	Chemical Reactions.	Converts energy, regulates, & distributes DC Power.	DC Power.
f) Environment	Adverse external conditions.	Protection/preserva- tion & Defenses.	Availability/ Reliability.
g) Structure	Manufacture.	Form & Fit.	Size/Weight/ Quality Assurance.

*Active Sonobuoy

FIGURE 3

B. The following lists USPTO Classes as they relate to the Sonobuoy functional subsets presented in FIGURE 2:

PTO Class -----	Most Likely Use -----
018 - Plastics	2g
029 - Metal Working	2g
033 - Geometrical Instruments	2f
065 - Glass Manufacturing	4a
072 - Metal Deforming	2g
073 - Measuring & Testing	3f
074 - Machine Elements & Mechanisms	4b
075 - Metallurgy	4
140 - Wireworking	4a
148 - Metal Treatment	4b
174 - Electricity, Conductors & Insulators	2e
181 - Acoustics	4a
204 - Chemistry, Electrical & Wave Energy	4a
234 - Selective Cutting	4b
235 - Registers	3d
242 - Winding and Reeling	3a
264 - Article Shaping (Non-metallic)	4
274 - Sound Recording and Reproducing	3a
307 - Electrical Transmission & Interconnect	3e
320 - Battery & Condenser Charging/Discharging	3e
321 - Electricity, Conversion Systems	3e
324 - Electricity, Measuring & Testing	3f
325 - Modulated Carrier Communication Systems	2c
328 - Miscellaneous Electronic Circuitry	3
329 - Demodulators & Detectors	3a
330 - Amplifiers	4a
331 - Oscillators	4a
332 - Modulators	3c
335 - Magnetically Operated Switches	4a
336 - Inductors	4a
338 - Resistors	4a
339 - Connectors	4a
340 - Electrical Communications	2
343 - Radio Communications	2
346 - Recorders	3d
350 - Optics, Systems & Elements	4a
357 - Active Solid State Devices	4a
360 - Dynamic Magnetic Information Storage & Retrieval	3d
361 - Electricity, Electrical Systems & Devices	3e
364 - Computers & Data Processing	3d
367 - Acoustic Wave Systems & Devices	2d
371 - Error Detection/Correction	3d
375 - Pulse/Digital Communications	3d
428 - Recording Medium	3d
429 - Chemistry, Elec. Current Producing Apparatus	4
455 - Telecommunications & Electronic Countermeasures	3f

V - CANDIDATE PATENTED INVENTIONS

Applicable to Sonobuoys

1. OVERALL (Sonobuoy) SYSTEM:

4,661,938	4,590,590	4,387,450
4,353,121	4,319,348	4,319,347
4,317,186	4,309,763	4,290,125
4,234,938	4,225,951	4,213,195
4,210,969		

2. MODULES:

a) Receiver:

4,388,727

b) Antenna: None found

c) RF Transmitter:

WO 81-00942	4,344,185	4,320,357
4,001,711		

d) Sonar Subsystem (Active Sonobuoys):

4,542,653	4,359,767	4,353,123
4,328,568	4,316,270	4,313,183
4,308,601	4,308,599	4,307,456
4,305,141	4,305,140	4,280,203
4,280,202	4,274,148	

e) Power Conversion:

4,487,821	4,466,244	4,388,384
4,185,143		

f) Environment (Availability, Reliability, Vulnerability):

WO 85-05195	WO 83-01306	4,482,896
4,426,712	4,097,837	4,110,726

g) Structure (Form & Fit):

4,423,660	4,383,831	4,075,725
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3. CIRCUITS:

a) Baseband Signal Processing:

4,468,758	4,591,802	4,459,680
4,459,679	4,445,199	4,441,200
4,419,657	4,369,508	4,365,320
4,346,476	4,315,325	4,304,004
4,301,522	4,276,622	4,267,584
4,245,332	4,238,836	4,208,732

b) Command/Control:

4,554,542	4,189,732
-----------	-----------

c) Coding and Modulation/Demodulation (Incl. Spread Spectrum):

WO 86-05050	WO 86-02213	WO 82-04365
4,606,039	4,447,907	4,447,214
4,367,444	4,361,817	4,309,674
4,303,894	4,282,497	4,268,802
4,259,648	4,190,801	4,189,690
4,187,465		

d) Envelope Signal Processing:

4,513,383	4,482,896	4,461,025
4,433,315	4,377,866	

e) Control/Distribution:

4,434,445	4,432,028	4,429,010
4,422,106	4,382,110	4,377,805
4,371,900	4,343,023	4,324,372
4,195,318	4,017,903	

f) Redundancy, ECM/ECCM & BITE:

WO 83-03141	4,412,348	4,365,346
-------------	-----------	-----------

4. MANUFACTURE, STORAGE, AND DEPLOYMENT:

4,295,211	4,279,025	4,186,370
4,020,514		

5. COMPONENTS and MATERIALS:

a) Electrical Functions:

- Amplify:

WO 86-03077	WO 84-03410	WO 84-01866
WO 82-01023	4,574,248	4,194,158
4,065,723		

- Attenuate (Shielding):

4,554,204	4,542,076	4,528,213
4,474,685		

- Couple:

4,591,802	4,433,315
-----------	-----------

- Compare (Logic):

4,346,480

- Convert: (A/D - D/A)

WO 86-05048	WO 86-05047	WO 86-04470
WO 86-02217	WO 85-04995	WO 85-02729

- Filter (RF):

WO 85-00481	WO 82-00551	WO 81-00934
WO 80-01227		

- Interconnect:

WO 86-03337	WO 84-01471	WO 83-04346
WO 82-01621		

- Invert:

4,571,510	4,554,510	4,524,328
-----------	-----------	-----------

● Regulate (DC):

4,628,426 4,626,976

● Sense:

4,454,763	4,449,210	4,421,384
4,414,471	4,400,805	4,380,808
4,375,680	4,364,117	4,344,159
4,326,418	4,326,275	4,320,472
4,313,185	4,311,391	4,296,482
4,287,582	4,236,235	4,235,113
4,228,532	4,208,737	

● Shape:

4,532,475 4,531,095

● Stabilize:

4,442,546

● Switch (Signal):

4,564,843

● Transform (Signal): None found

b) Physical/ Mechanical:

WO 87-03163	WO 84-04648	WO 82-03960
WO 82-02458	WO 81-03734	4,668,032
4,658,331	4,536,955	4,513,353
4,495,546		

VI - ASSIGNEES

* * * * *

The following organizations and individuals (Assignees) own the patents selected for analysis:

Company -----	Applicability -----
Advanced Micro Devices, Inc.	3
Advanced Technology Laboratories	2
AEL Microtel, Limited	2
Alps Electric Company, Ltd. (Japan)	2
American Tel & Tel Corporation	1
AMP, Incorporated	3
Audiological Engineering Corporation	2
Bell Telephone Laboratories	1
Bendix Corp (Allied)	3
Boeing Company	2
BSR North America, Ltd.	2
Burroughs Corporation	2
Canadian Patents & Development, Ltd.	2
CII Honeywell Bull	1
Carver, Robert W.	2
Carome, Edward F.	2
Caterpillar Tractor Co.	2
Compagnie de Geophysique, France	3
Cooper, Charles E.	2
Crown Controls Corporation	1
Cyr, Reginald J.	1
DeltaLab Research, Incorporated	1
Digital Equipment Corporation	3
E-Systems, Inc.	2
EIC Laboratories, Incorporated	3
EMI, Limited	1
Edo Western Corporation	3
Etat Francais	2
Fairfield Industries	2
Federal Screw Works	3
Fisher, Charles B.	1
Fried Krupp, GMBH	2
Fujitsu, Limited, Japan	3
General Dynamics Corporation	1
General Electric Company	3
General Motors Corporation	1
Golforth, Melvin L.	2
Gould, Inc.	1
Harris Corporation	2
Hazeltine Corporation	3
Hewlett-Packard Company	3

VI - ASSIGNEES - Continued

Hitachi, Limited	1
Honda, Keisuk	1
Honeywell, Incorporated	3
Hughes Aircraft Company, (GM)	3
International Computer, Limited (UK)	2
Lahr, William E.	1
Leland Stanford University	3
Lockheed Cprporation	1
Lowrence Electronics, Incorporated	2
Magnavox Corporation	2
Malloy, James T.	2
Marconi Instruments, Limited	1
Massachusetts Institute of Technology	3
Matsushita Electric	3
McDonnell Douglass Corporation	2
Memorex Corporation	2
Mettler, Rcilin W.	2
Meyer Sound Laboratories	2
Minister of National Defense, Canada	2
Mobil Oil Corporation	1
Motorola, Incorporated	3
Mostek Corporation	2
Murata Manufacturing Company	2
Nanodata Computer Corporation	2
NEC Corporation	3
Nikon KK Ltd., Japan	2
Nippon Electric Company, Ltd., Japan	3
Nippon T&T Public Corporation	2
Occidental Chemical Corporation	3
Pertersen, Willy	1
Plessy Handel AG	2
Plessy Overseas, Limited	2
Polaroid Corporation	2
PureCycle Corporation (Anatel)	3
RCA Corporation	2
Racal Research, Limited	1
Raytheon Company	3
Refraction Technology, Incorporated	3
Rockwell International Corporation	2
Sanders Associates	2
Sangamo Weston, Limited	2
Saylors, James, A.	1
Sekisui Kagaku Kogyo KK	2
Siemens, AG, Fed.Rep of Germany	3
Sims, Claude, C.	2
Sperry Corporation	3
Sumito Metal Mining Company, Limited	2
Stoneleigh Trust, The	2
Sunstrand Data Control, Incorporated	3

VI - ASSIGNEES - Continued

Tektronix Incorporated	2
TDK Electronics, Limited	2
Thomson-CSF, France	3
Tokyo Shibura Denki KK	1
Toyo Communications Equipment Co.,Ltd.	3
U.K. Government, Secretary of Defense	3
U.S. Philips Corporation	2
United Geophysical Corporation	2
Verbatim Corporation	1
Victor Company of Japan	3
Washington Research Foundation	2
Western Electric Corporation	1
Western Geophysical	1
Westinghouse Electric Company	3
Westinghouse, Canada	2
Wu, Jium-tsong	2
Wulfsberg, Paul G.	2

107 Listed

Key to applicability:

3= Most
2= Moderate
1= Marginal
0= None - - (Not listed)

VII - BENEFITS OF THE MOST LIKELY CANDIDATES

Patent No.
4,017,903

Owner:
Hewlett-Packard

Expires:
12 Apr 94

- A. Description of Invention: A system for high density data recording and/or reproduction on magnetic tape at low tape speeds.
- B. Main Advantages: Tape speeds of 15/32 ips with densities of 20 Kilobits/inch are possible
- C. Main Application(s) in Sonobuoys: For recording undersea and timebase data during long "standby" periods with recall of the data on command.
- D. Further Development Needed: Unknown (at present)
- E. Availability: Unknown (at present)
- F. Contact: Eugene H. Valet, Esquire
Hewlett-Packard Company
PO Box 10301
Palo Alto, CA 94303-0890 (415) 857-1501 X 2717
-

Patent No.
4,185,143

Owner:
Sec Def of UK

Expires:
22 Jan 97

- A. Description of Invention: A Water-activated battery based on metal/organo couples which can sustain high currents for short periods.
- B. Main Advantages: Considerably less expensive to manufacture than cells employing Magnesium/silver couples.
- C. Main Application(s) in Sonobuoys: For continuous operation at low power levels, with a high power pulse mode capability.
- D. Further Development Needed: None
- E. Availability: Immediate
- F. Contact: Elliot I. Pollock, Esquire
Pollock, VandeSande & Priddy
1990 "M" Street, NW - Suite 800
Washington, DC 20036 (202) 331-7111

Patent No.
4,186,370

Owner:
Raytheon

Expires:
29 Jun 87

- A. Description of Invention: Suspension system for an air-dropped sonobuoy.
- B. Main Advantages: Lower center of gravity for a Sonobouy after launch.
- C. Main Application(s) in Sonobuoys: Overall configuration.
- D. Further Development Needed: Unknown (at present)
- E. Availibility: Unknown (at present)
- F. Contact: Richard M. Sharkanski, Esquire
Patent Counsel,
Raytheon Company
100 Hayden Avenue
Lexington, MA 02173
(617) 860-4827

Patent No.
4,189,690

Owner:
Hughes Aircraft

Expires:
19 Feb 97

- A. Description of Invention: Means for directly modulating an RF carrier to produce linear frequency deviation.
- B. Main Advantages: Problems inherent in cavity-type oscillators are minimized.
- C. Main Application(s) in Sonobuoys: Frequency multiplication circuitry is not required.
- D. Further Development Needed:
- E. Availibility:
- F. Contact: Elliott N. Kramsky, Esquire
5850 Conoga Avenue - Suite 400
Woodland Hills, CA 91367
(818) 992-5221

Patent No.
4,208,737

Owner:
Westinghouse

Expires:
17 Jun 97

- A. Description of Invention: A pressure gradient dipole hydrophone.
- B. Main Advantages: Very low vibration sensitivity and high acoustic sensitivity, with low flow noise response.
- C. Main Application(s) in Sonobuoys: In conditions of heavy seastate.
- D. Further Development Needed: None
- E. Availability: Unit has been built, and is undergoing tests
(3/22/88)
- F. Contact: Dean Schron, Esquire
Senior Counsel
Westinghouse Electric Corp.
1310 Beulah Road
Pittsburgh, PA 15235 (412) 256-5237

Patent No.
4,213,195

Owner:
Raytheon

Expires:
15 Jul 97

- A. Description of Invention: An underwater sonic direction finding system for use at low frequencies.
- B. Main Advantages: Provides precise measurement of the direction of sonic sources down to 50 Hz.
- C. Main Application(s) in Sonobuoys: For active and passive sonars where azimuth measurement is required.
- D. Further Development Needed: Unknown (at present)
- E. Availability: Unknown (at present)
- F. Contact: Richard M. Sharkanski, Esquire
Patent Counsel,
Raytheon Company
100 Hayden Avenue
Lexington, MA 02173 (617) 860-4827

Patent No.
4,245,332

Owner:
Honeywell
(Elac-Nautic GmbH)

Expires:
13 Jan 98

A. Description of Invention: Receiver circuitry for suppressing noise and interference signals in echo-ranging systems.

o Used in a riverbottom echograph in West Germany

B. Main Advantages: Error-free selection of the primary target.

C. Main Application(s) in Sonobuoys: When improved target range measuring accuracy is required.

D. Further Development Needed: None

E. Availability: Via a License arrangement.

F. Contact: Charles L. Rubow, Esquire
Honeywell, Incorporated
Honeywell Plaza
Minneapolis, MN 55408

(612) 870-6461

Patent No.
4,280,202

Owner:
Allied/Bendix

Expires:
21 Jul 98

A. Description of Invention: Hydrophone signal processor for the detection of coded waveforms.

B. Main Advantages: Can be implemented in integrated circuit form.

C. Main Application(s) in Sonobuoys: For transmission of communications from submarine to above surface platforms.

D. Further Development Needed: Unknown (at present)

E. Availability: Unknown (at present)

F. Contact: Robert C. Smith, Esquire
Regional Patent Counsel
Allied Signal Corporation
15825 Roxford Street
Sylmar, CA 91342

(213) 367-0111

Patent No.
4,295,211

Owner:
Thompson-CSF

Expires:
13 Oct 98

- A. Description of Invention: A jettisonable Sonobuoy configuration which rapidly separates the upper electronics section from the diving apparatus upon impact with the ocean.
- B. Main Advantages: Rapid deployment of Hydophone at depths to 2,000 meters.
- C. Main Application(s) in Sonobuoys: Where rapid deployment of the sonar head to great depths is required
- D. Further Development Needed: Unknown (at present)
- E. Availability: Unknown (at present)
- F. Contact: Allen Kirkpatrick, III, Esquire
Cushman, Darby & Cushman - 11th Floor
1615 "L" Street NW
Washington, DC 20036-5601 (202) 861-3000

Patent No.
4,300,813

Owner:
Sperry (Unisys)

Expires:
17 Nov 98

- A. Description of Invention: A fiber optic sonar transducer.
- B. Main Advantages: Eliminates the need for active components at the transducer, and cost saving.
- C. Main Application(s) in Sonobuoys: To replace Piezo-electric/Ferroelectric/magnetic transducers.
- D. Further Development Needed: Unknown (at present)
- E. Availability: Unknown (at present)
- F. Contact: L. Joseph Marhoeffter, Esquire (Howard Terry retired)
Vice President, Patents & Licensing
Unisys Corporation
PO Box 500
Blue Bell, PA 19422 (215) 542-5823

Patent No.
4,309,763

Owner:
Refraction Technology

Expires:
05 Jan 99

- A. Description of Invention: A digital underwater seismic exploration device.
- B. Main Advantages: Digital transmission provides improved S/N.
- C. Main Application(s) in Sonobuoys: Detection of LF acoustic waves.
- D. Further Development Needed: Adaptation to meet Navy requirements.
- E. Availability: Unknown (at present)
- F. Contact: Kenneth Roy Glaser, Esquire
Glaser, Griggs & Schwartz
Three Lincoln Centre
Dallas, TX 75240

(214) 770-2400

Patent No.
4,313,185

Owner:
GE, Syracuse

Expires:
26 Jan 99

- A. Description of Invention: A noise cancelling vibration sensing system.
- B. Main Advantages: 0.1 Angstrom sensitivity with minimum background noise pickup.
- C. Main Application(s) in Sonobuoys: Deeply submerged directional acoustic sensing.
- D. Further Development Needed: Device has been built and tested using private funds.
- E. Availability: Owner suggests NRL sponsor further development work by GE on adaptation to Sonobuoys.
- F. Contact: Carl W. Baker, Esquire
Patent Counsel,
General Electric Company
PO Box 4840
Syracuse, NY 13221

(315) 456-3682

Patent No.
4,315,325

Owner:
PureCycle Corp

Expires:
09 Feb 99

- A. Description of Invention: Circuitry for discriminating received reflected pulses from noise.
- B. Main Advantages: An economical circuit method for compensating transmission losses in echo ranging systems.
- C. Main Application(s) in Sonobuoys: Where long-range target detection is required.
- D. Further Development Needed: Unknown (at present)
- E. Availability: Unknown (at present)
- F. Contact: Robert B. Washburn, Esquire
Woodcock, Washburn, Kurtz, Mackiewicz & Norris
1800 United Engineers Building
30 South 17th Street
Philadelphia, PA 19103 (215) 568-3100

Patent No.
4,326,275

Owner:
Hazeltine

Expires:
20 Apr 99

- A. Description of Invention: A directional underwater sonic transducer.
- B. Main Advantages: Rugged, shock resistant, and easily assembled..
- C. Main Application(s) in Sonobuoys: The basic design may be readily modified to meet specific operating environments.
- D. Further Development Needed: Operational prototype has been built.
Unit would require productionizing.
- E. Availability: Unknown (at present)
- F. Contact: Edward A. Onders, Esquire
Associate General Counsel
Hazeltine Corporation
East Pulaski Road
Greenlawn, NY 11740 (516) 261-7000

402

Patent No.
4,346,476

Owner:
Fujitsu, Ltd.
(US 152,556)

Expires:
24 Aug 99

- A. Description of Invention: D/A, A/D converter for a PCM transmission system.
- B. Main Advantages: A Codec which uses basic Integrated circuit technology.
- C. Main Application(s) in Sonobuoys: Conversion of acoustic signals for PCM transmission.
- D. Further Development Needed: Unknown (at present)
- E. Availability: Unknown (at present)
- F. Contact: Attorney of record not cited in patent.

Patent No.
4,359,767

Owner:
Siemens AG

Expires:
09 Nov 99

- A. Description of Invention: An electronically-focused acoustic beamformer.
- B. Main Advantages: Dynamic focusing of acoustic energy.
- C. Main Application(s) in Sonobuoys: Where rapid beam shaping and directivity is required.
- D. Further Development Needed: Unknown (at present)
- E. Availability: Siemens' R&D in this area is now performed in California.
- F. Contact: Willhelm von Lieres, Esquire
Patent Counsel,
Siemens Corporate Research & Support, Inc.
186 Wood Avenue South
Iselin, NJ 08830

(201) 321-3926

011

Patent No.
4,364,117

Owner:
Edo Western Corp.

Expires:
14 Dec 99

- A. Description of Invention: Ruggedized Sonar Transducer.
- B. Main Advantages: Designed to withstand high hydrostatic pressures and extreme mechanical and explosive shock.
- C. Main Application(s) in Sonobuoys: Where deep sea transducer deployment is required.
- D. Further Development Needed: None - Several versions have been sold to commercial & Navy customers. Data sheets are available from Gordon Snow.
- E. Availability: By direct purchase.
- F. Contact: Mr. R. A. Lapetina
EDO Corporation - Western Division
2645 South 500 West
Salt Lake City, UT 84115 (801) 486-7481

Patent No.
4,365,320

Owner:
Institut Francis

Expires:
21 Dec 99

- A. Description of Invention: Circuitry for determining the instant of receiving an acoustic wave.
- B. Main Advantages: Improved echo-ranging sensor for time-base recording of acoustic waves.
- C. Main Application(s) in Sonobuoys: For pinpointing the location of underwater explosions.
- D. Further Development Needed: Unknown (at present)
- E. Availability: Unknown (at present)
- F. Contact: I. William Millen, Esquire
Millen & White
503 Crystal Mall, Bldg 1.
Arlington, VA 22202 (703) 892-2200

Patent No.
4,383,831

Owner:
Raytheon

Expires:
17 May 00

- A. Description of Invention: A suspension system for an air-dropped Sonobuoy.
- B. Main Advantages: Neutralizes the adverse effects of high sea state.
- C. Main Application(s) in Sonobuoys: Stabilizes the longitudinal axis of a Sonobuoy in a vertical direction.
- D. Further Development Needed: Unknown (at present)
- E. Availability: Unknown (at present)
- F. Contact: Richard M. Sharkanski, Esquire
Patent Counsel,
Raytheon Company
100 Hayden Avenue
Lexington, MA 02173
(617) 860-4827

Patent No.
4,388,384

Owner:
EIC Labs. Inc. & SERI

Expires:
14 June 00

- A. Description of Invention: A photoelectrochemical secondary battery.
- B. Main Advantages: Restoration of battery charge by sunlight.
- C. Main Application(s) in Sonobuoys: Power source which can maintain charge over prolonged periods.
- D. Further Development Needed: Unknown (at present)
- E. Availability: Unknown (at present)
- F. Contact: Kenneth L. Richardson, Esquire
Solar Energy Research Institute
1617 Cole Boulevard
Golden, CO 80401
(303) 231-7724

(referred IPD to EIC, 111 Chapel St. Newton, MA - No answer on (617) 965-2710.

Patent No.
4,400,805

Owner:
Rockwell

Expires:
23 Aug 00

- A. Description of Invention: Narrow bandwidth acoustic transducer.
- B. Main Advantages: Can achieve resonance at a predetermined acoustic wave frequency.
- C. Main Application(s) in Sonobuoys: For communications between submarines and aircraft.
- D. Further Development Needed: Unknown (at present)
- E. Availability: Unknown (at present)
- F. Contact: H. Frederick Hamann, Esquire
Rockwell International Corporation
3370 Miraloma Avenue
Anaheim, CA 92803 (714) 632-1663

Patent No.
4,407,907

Owner:
Tokyo Shibaura KKK

Expires:
01 Oct 00

- A. Description of Invention: Air electrode fuel cell.
- B. Main Advantages: Cell is capable of preventing fuel leakage under heavy duty discharge conditions.
- C. Main Application(s) in Sonobuoys: Long shelf life with a high discharge current capability.
- D. Further Development Needed: Unknown (at present)
- E. Availability: Unknown (at present)
- F. Contact: Richard L. Schwaab, Esquire
Schwartz, Jeffery, Schwaab, Mack,
Blumenthal & Evans - Suite 510
1800 Diagonal Road
Alexandria, VA 22313-0299 (703) 836-9300

958

Patent No.
4,419,657

Owner:
Fed. Screw Works

Expires:
06 Dec 00

- A. Description of Invention: Audio signal digitization coder/decoder.
- B. Main Advantages: The circuitry provides improved signal-to-noise over the audio spectrum with wide dynamic range.
- C. Main Application(s) in Sonobuoys: Digitization of hydrophone baseband signals.
- D. Further Development Needed: Unknown (at present)
- E. Availability: Unknown (at present)
- F. Contact: Don E. Harness, Esquire
Harness, Dickey & Pierce
1500 North Woodward
Birmingham, MI 48011 (313) 642-7000

Patent No.
4,421,384

Owner:
Sperry (Unisys)

Expires:
20 Dec 00

- A. Description of Invention: Fiber optic acoustic transducer.
- B. Main Advantages: Allows coupling of sensor data to the Sonobuoy transmitter via fiber optic cable, thus, negating the need for deeply submerged electronics.
- C. Main Application(s) in Sonobuoys: For high sensitivity detection in underwater target locating systems.
- D. Further Development Needed: Unknown (at present)
- E. Availability: Unknown (at present)
- F. Contact: L. Joseph Marhoeffer, Esquire
Vice President, Patents & Licensing
Unisys Corporation
PO Box 500
Blue Bell, PA 19422 (215) 542-5823

034

Patent No.
4,426,712

Owner:
Mass. Inst. Tech.

Expires:
17 Jan 01

- A. Description of Invention: A digital correlation receiver for GPS.
- B. Main Advantages: Simplicity, due to reduced synchronization and clocking requirements.
- C. Main Application(s) in Sonobuoys: Circuitry is ammenable to integrated circuoat design.
- D. Further Development Needed: Unknown (at present)
- E. Availibility: Unknown (at present)
- F. Contact: John T. Preston, Esquire
Director, Technology Licensing Office
Massachusetts Institute of Technology
77 Massachusetts Avenue
Cambridge, MA 02139 (617) 253-6966

172

Patent No.
4,449,210

Owner:
Hughes Aircraft

Expires:
15 May 01

- A. Description of Invention: A fiber optic hydrophone transducer for detecting the magnitude and direction of applied acoustic signals.
- B. Main Advantages: Low power consumption and improved reliability.
- C. Main Application(s) in Sonobuoys: Deeply submerged acoustic wave detection.
- D. Further Development Needed: Unknown (at present)
- E. Availibility: Unknown (at present)
- F. Contact: Elliott N. Kramsky, Esquire
5850 Conoga Avenue - Suite 400
Woodland Hills, CA 91367 (818) 992-5221

Patent No.	Owner:	Expires:
4,474,685	Occidental Chemical	02 Oct 01

A. Description of Invention: Electroconductive molding compositions for EMI sheilding.

B. Main Advantages: Constant attenuation of 20db over the range of 0.5 to 1000 Mhz, and easily molded.

C. Main Application(s) in Sonobuoys: Component shielding.

D. Further Development Needed: Unknown (at present)

E. Availibility: Unknown (at present)

F. Contact: James F. Tao, Esquire
Occidental Chemical Corporation
PO Box 189
Niagara Falls, NY 14302 (716) 773-8432

Patent No.	Owner:	Expires:
4,495,546	Matsushita	22 Jan 02

A. Description of Invention: Method of mounting hybrid Integrated circuits on flexable mother boards.

B. Main Advantages: Provides a hybrid integrated circuit component best suited for compact and light weight electronic equipment.

C. Main Application(s) in Sonobuoys: High density circuitry.

D. Further Development Needed: Technology is used in commercial VTRs.
Custom design needed for Sonobuoy applications.

E. Availibility: Technology probably available through Licensing.

F. Contact: Vincent M. Creedon, Esquire
Wenderoth, Lind & Ponack
Southern Building - Suite 700
Washington, DC 20005 (202) 371-8850

Patent No. Owner: Expires:
4,513,353 AMP, Incorporated 23 Apr 02

- A. Description of Invention: A device for connecting leadless IC packages.
- B. Main Advantages: Allows for fast, accurate alignment of contact surfaces during manufacture.
- C. Main Application(s) in Sonobuoys: Fabrication of circuitry.
- D. Further Development Needed: Unknown (at present)
- E. Availability: Unknown (at present)

F. Contact: William Hintze, Esquire
Patent Licensing
AMP, Incorporated
2109 Fulling Mill Road
Harrisburg, PA 17105

(717) 986-5465

055

Patent No. Owner: Expires:
4,531,095 Japan Victor Co. 23 Jul 02

- A. Description of Invention: White noise immune noise reduction circuitry.
- B. Main Advantages: When high-impulse noise reduction is required.
- C. Main Application(s) in Sonobuoys: In hydrophone preamplifier stages.
- D. Further Development Needed: Unknown (at present)
- E. Availability: Unknown (at present)

F. Contact: Robert L Price, Esquire (Suggested 8 other JVC patents)
Lowe, Price, Le Blanc, Becker & Shur
427 North Lee Street
Alexandria, VA 22314

(703) 684-1111

Patent No.
4,542,076

Owner:
Siemens, AG

Expires:
17 Sep 02

- A. Description of Invention: Shrinkable molded plastic component shielding.
- B. Main Advantages: Cost saving.
- C. Main Application(s) in Sonobuoys: Shielding of cable fittings.
- D. Further Development Needed: Unknown (at present)
- E. Availability: Siemens is prepared to grant a License.
- F. Contact: Willhelm von Lieres, Esquire
Patent Counsel,
Siemens Corporate Research & Support, Inc.
186 Wood Avenue South
Iselin, NJ 08830 (201) 321-3926

011

Patent No.
4,554,510

Owner:
Leland Stanford
(Litton owns Rights)

Expires:
19 Nov 02

- A. Description of Invention: Bidirectional fiber optic amplifier.
- B. Main Advantages: Wide bandwidth data transmission through fiber optics in both directions.
- C. Main Application(s) in Sonobuoys: Two-way transmission of data between deeply-submerged transducer and surface electronics package.
- D. Further Development Needed: Unknown (at present)
- E. Availability: Unknown (at present)
- F. Contact: Edmund W. Rusche, Esquire
Patent & Licensing Department - MS-30
Litton Industries, Incorporated
5000 Canoga Avenue
Woodland Hills, CA 91367 (818) 716-3143

Patent No.
4,591,802

Owner:
NEC Corporation

Expires:
27 May 03

- A. Description of Invention: A multistage FET feedback audio amplifier.
- B. Main Advantages: Fewer components, and improved low frequency amplifier response.
- C. Main Application(s) in Sonobuoys: Component reduction.
- D. Further Development Needed: Unknown (at Present)
- E. Availability: Unknown (at Present)

F. Contact: Charles A. Laff, Esquire
Laff, Whitesel, Conte & Saret
401 North Michigan Avenue, Suite 2000
Chicago, IL 60611 (312) 649-0200

080

Patent No.
WO 81-00942

Owner:
Toyo Comm. Equip, Ltd. 02 Apr 81
(JP 7900308)

Expires:

- A. Description of Invention: A multi-channel FM two-way data link.
- B. Main Advantages: Reduces noise and suppresses interference over a Wide bandwidth by use of a phased-locked loop.
- C. Main Application(s) in Sonobuoys: Means for simultaneous two-way command and data transmission.
- D. Further Development Needed: Unknown (at present)
- E. Availability: Unknown (at present)
- F. Contact: Attorney-of-record not cited.

Patent No.
WO 82-04365

Owner:
Motorola
(US 8200499)

Expires:
09 Dec 99

- A. Description of Invention: FM transmitter modulation control circuitry.
- B. Main Advantages: Enhanced audio signal quality.
- C. Main Application(s) in Sonobuoys: In the audio section for amplifying hydrophone signals.
- D. Further Development Needed: Unknown (at present)
- E. Availability: Unknown (at present)
- F. Contact: Vincent J. Rauner
VP Patents & Trademarks
Motorola, Incorporated
1302 E. Algonquin Road
Schaumburg, IL 60196
(312) 397-5000

029

Patent No.
WO 86-03077

Owner:
AT&T
(US 8502156)

Expires:
22 May 03

- A. Description of Invention: Digital automatic gain control circuit.
- B. Main Advantages: Receiver output can be held essentially constant during wide variations of received signal amplitude.
- C. Main Application(s) in Sonobuoys: Command-control receiver section.
- D. Further Development Needed: Unknown (at Present)
- E. Availability: Unknown (at Present)
- F. Contact: William L. Keefauver, Esquire
Patent Counsel
AT&T Bell Laboratories
600 Mountain Avenue
Murray Hill, NJ 07974
(201) 582-2233

006

Patent No.
WO 86-03337

Owner:
Hughes Aircraft
(US 8502120)

Expires:
05 Jun 03

A. Description of Invention: Dimensionally stable interconnect boards.

B. Main Advantages: Component passivation at low cost.

C. Main Application(s) in Sonobuoys: Component manufacturing.

D. Further Development Needed: Unknown (at present)

E. Availibility: Unknown (at present)

F. Contact: Elliott N. Kramsky, Esquire
5850 Conoga Avenue
Woodland Hills, CA 91367

(818) 992-5221

052

VIII- PATENT OWNER SURVEY

* * * * *

Experience has shown that the most available and reliable source for information about the current status of a U.S. patented invention is through the Attorney-of-record cited on the front page of each patent.

Accordingly, during the reporting period IPD initiated contacts with the attorneys via written inquiries using the following approach:

Name/address

Re: U.S. Patent No. to

Dear Mr. :

Under Project NICRAD-85-NADC-008 with the U.S. Navy, IPD is providing an analysis and evaluation of the applicability of U.S. patented inventions to the design of next generation Sonobuoys, and is to recommend contractor sources for implementing the selected inventions.

The referenced U.S. patent, in which you are the Attorney of record, has been selected for further evaluation.

Would you be kind enough to help us?

It appears to IPD that this invention offers considerable promise towards improving performance and/or cost saving in future Sonobuoy designs. However, in order to complete our evaluation of this, and other candidate inventions, we would appreciate knowing its present status of development, and the extent of further development required to bring the invention to the point of practical application. We would also appreciate your suggested path to its implementation.

I have enclosed a copy of the front page of the patent to help you locate the particulars.

Your brief response to this matter will be gratefully appreciated.

Please do not hesitate to call me if there are any questions.

Sincerely,

Richard Jenkins

RJ:aa
Encls:
f.-310

The above approach produced fifteen (15) response letters, to date, from the solicitations listed, as follows:

Assignee	Req.	Patent Nos.	Contact	Resp.
-----	---	-----	-----	-----
1. Hewlett-Packard	3-29	4,017,903	Valet	Incomplete
2. Sec Def of UK	3-7	4,185,143	Pollock	Incomplete
3. Raytheon	3-7	4,186,370	Sharkanski	None
4. Raytheon	3-7	4,213,195	"	None
5. Raytheon	3-7	4,383,831	"	None
6. Hughes	3-7	4,189,690	Kramsky	None
7. Hughes	3-7	4,449,210	"	None
8. Hughes		WO 86-03337	Laslo	
9. Westinghouse	3-7	4,208,737	Schron	Complete
10. Honeywell	3-7	4,245,332	Rubow	Complete
11. Allied/Bendix	3-7	4,280,202	Smith	None
12. Thompson-CSF	3-7	4,295,211	Kirkpatrick	Incomplete
13. Sperry	3-21	4,300,813	Terry (Ret.)	None
14. Sperry	3-21	4,421,384	"	None
15. Refract. Technol.	3-21	4,309,763	Glaser	Complete
16. GE, Syracuse	3-21	4,313,185	Baker	Complete
17. PureCycle	3-21	4,315,325	Washburn	None
18. Hazeltine	3-21	4,326,275	Onders	Complete
19. Fujitsu	3-21	4,346,476	"	None
20. Siemens, AG	3-21	4,359,767	von Lieres	Complete
21. Siemens, AG	3-21	4,542,076	"	Complete
22. Edo Western	3-21	4,364,117	Lapetina	Complete
23. Institut Francis	3-21	4,365,320	Millin	None
24. EIC Labs (SERI)	3-21	4,388,384	Richardson	See SERI
25. Rockwell	3-21	4,400,805	Hanann	None
26. Tokyo Shibaura	3-21	4,407,907	Schwaab	Incomplete
27. Fed. Screw Works	3-21	4,419,657	Harness	None
28. MIT	3-21	4,426,712	Preston	None
29. Occidental	3-21	4,474,685	Tao	None
30. Matsushita	3-21	4,495,546	Creedon	Complete
31. AMP, Inc.	3-21	4,513,353	Hintze	None
32. Japan Victor	3-21	4,531,095	Price	Complete
33. Leland Stanford	3-21	4,554,510	Nieman	Incomplete
34. NEC	3-21	4,591,802	Laff	None
35. Toyo Commo.		WO 81-00942		
36.		WO 81-03734		
37. Motorola		WO 82-04365		
38. AT&T		WO 86-03077		
39.		WO 87-03163		

IPD will concentrate on obtaining and entering the outstanding data during the ensuing report period.

FIGURE 4 - MOST LIKELY CANDIDATES

* * * * *

Cover pages of the "Most" relevant patents selected from
project inception (18 January 1983 to 30 June 1988)
and received to date.

NICELEV.RPT

[54] PULSE CODE MODULATION RECORDING AND/OR REPRODUCING SYSTEM

[75] Inventor: Peter F. Chu, Poway, Calif.

[73] Assignee: Hewlett-Packard Company, Palo Alto, Calif.

[22] Filed: Aug. 27, 1975

[21] Appl. No. 608,139

[52] U.S. Cl. 360/40; 360/44

[51] Int. Cl.² G11B 5/09

[58] Field of Search 360/40, 44; 340/347 DD

[56] References Cited

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3,641,524	2/1972	Norris	360/40
3,852,809	12/1974	Coker, Jr.	360/40
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Primary Examiner—Vincent P. Canney

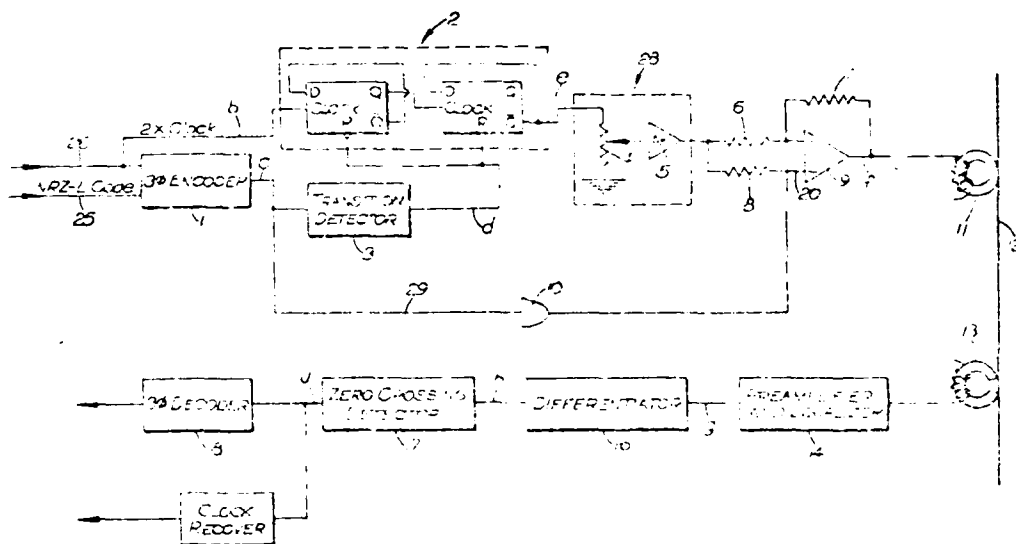
Attorney, Agent, or Firm—David A. Boone

[57]

ABSTRACT

A system for high-density data recording at low tape speeds receives a unipolar signal representing encoded digital data and transforms it to a bipolar signal having a constant pulse width. The low-frequency response required of the system is minimized because the power spectrum of the signal is altered through a time domain transformation. The narrow bandwidth enables the use of very low tape speeds at high bit packing densities. Tape speeds of 15/32 ips or less at densities about 20 thousand (k) bits per inch (BPI) are possible. The spectrum of the transformed code has no direct current (DC) component which eliminates the need for a base line compensator in the reproducing portion of the system.

10 Claims, 4 Drawing Figures



[54] WATER ACTIVATED BATTERIES

[75] Inventors: Dennis C. P. Birt, Bournemouth;
Leonard J. Pearce, Broadstone, both
of England

[73] Assignee: The Secretary of State for Defence in
Her Britannic Majesty's Government
of the United Kingdom of Great
Britain and Northern Ireland,
London, England

[21] Appl. No.: 880,513

[22] Filed: Feb. 23, 1978

[30] Foreign Application Priority Data

Feb. 23, 1977 [GB] United Kingdom 7736/77

[51] Int. Cl.² H01M 6/34

[52] U.S. Cl. 429/119; 429/213

[58] Field of Search 429/118, 119, 213, 110,
429/149, 152, 72

[56]

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3,884,720	5/1975	Armstrong	429/119
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Primary Examiner—Anthony Skapars

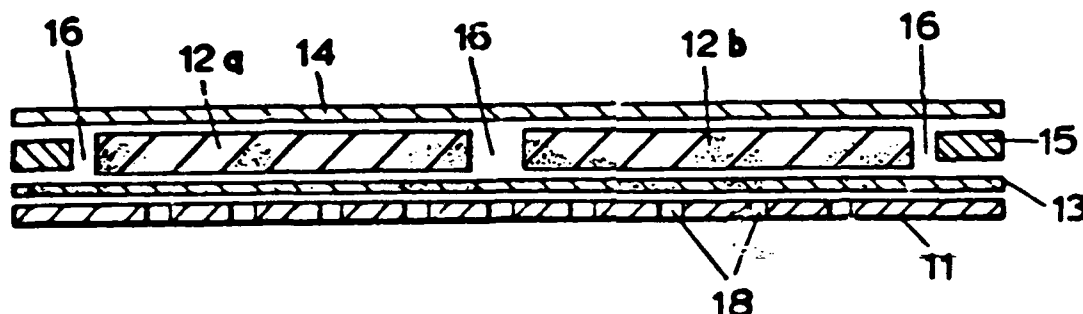
Attorney, Agent, or Firm—Pollock, VandeSande and
Priddy

[57]

ABSTRACT

In the cell of a water activated battery using a metal/or-
gano-halogen couple wherein the anode and cathode
are formed as planar members with a porous insulator
sandwiched between there are provided channels to
allow the electrolyte access throughout the cell. The
channels may be cut in the cathode or the cathode may
be formed as discrete portions of cathode reactant mate-
rial deposited on a current collector backing plate.

8 Claims, 6 Drawing Figures



[54] STABILIZED SONOBUOY SUSPENSION

[75] Inventors: John Cupolo, Bristol; David J. Salisbury, Barrington; Charles W. Onelletta, Portsmouth, all of R.I.

[73] Assignee: Raytheon Company, Lexington, Mass.

[21] Appl. No.: 939,562

[22] Filed: Sep. 5, 1978

[51] Int. Cl.: B63B 21/52

[52] U.S. Cl.: 367/4; 9/8 R; 367/130

[58] Field of Search: 9/8 R; 340/2, 3 T, 8 S

[56] References Cited

U.S. PATENT DOCUMENTS

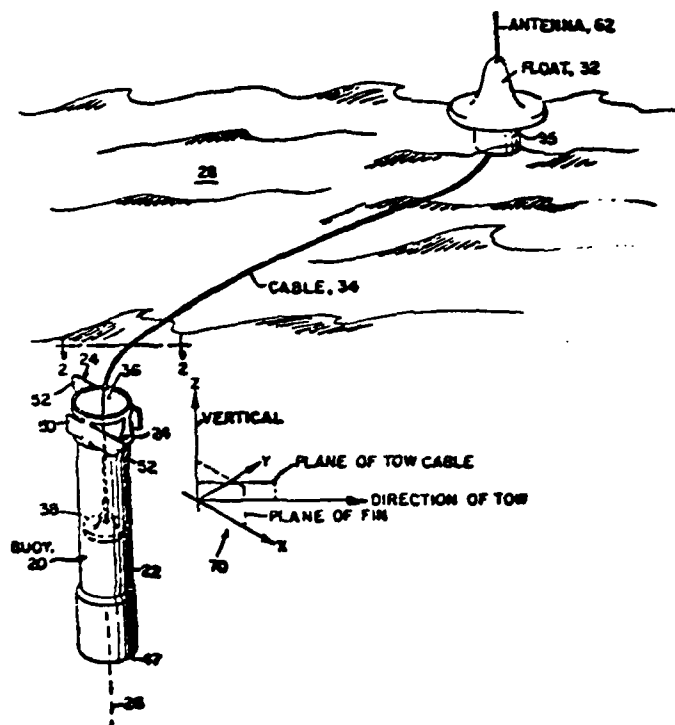
3,093,808	6/1963	Tatnall et al.	340/2
3,115,831	12/1963	Suter	340/2 X
3,720,909	3/1973	Sikora	340/2 X
4,004,309	1/1977	Gongwer	9/8 R

Primary Examiner—Richard A. Farley
Attorney, Agent, or Firm—Joseph D. Pannone, Milton D. Bartlett

[57] ABSTRACT

A suspension system for an air-dropped sonobuoy includes a transducer housing wherein the upper portion is emptied upon deployment of a float. The weight distribution of the transducer and housing provides for a center of mass and a center of buoyancy at a location beneath a pivot in the upper portion of the housing. A suspension line connects the pivot with the float, and a pair of opposed extensible fins at the top of the housing locate the center of hydrodynamic pressure at the pivot. Thereby, the housing is maintained in a stabilized vertical attitude during descent through the water and during deployment at a predetermined depth independently of a difference in velocity of fluid movement at the float and at the sonobuoy.

6 Claims, 6 Drawing Figures



[54] **RESONANT LINEAR FREQUENCY MODULATOR**

[75] Inventors: George F. Bock, Fountain Valley; Bernard L. Walsh, Jr., Northridge, both of Calif.

[73] Assignee: Hughes Aircraft Company, Culver City, Calif.

[21] Appl. No.: 910,805

[22] Filed: May 30, 1978

[51] Int. Cl.² H03C 3/22

[52] U.S. Cl. 332/30 V; 331/117 D

[58] Field of Search 332/16 T, 18, 22, 27-30 V; 331/117 V, 36 C

[56] **References Cited**

U.S. PATENT DOCUMENTS

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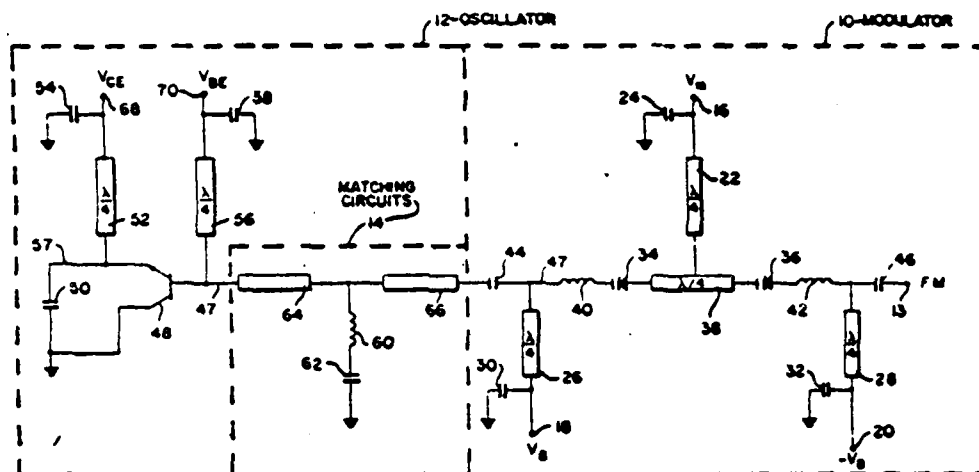
Primary Examiner—Siegfried H. Grimm

Attorney, Agent, or Firm—Elliot N. Kramsky; W. H. MacAllister

[57] **ABSTRACT**

A circuit which modulates an r.f. carrier to produce an FM signal having a substantially linear frequency relation to an applied modulating voltage over a selected deviation bandwidth. An r.f. oscillator having an output matching circuit supplies the carrier to a modulator. The impedance of the oscillator is adjusted by the matching circuit to present a desired reactive mismatch to the modulator over the bandwidth. The modulator includes a pair of voltage dependent reactive impedance elements, oppositely biased and separated by a quarter wavelength line which acts as an impedance inverter. A modulating voltage applied to both of the elements causes a reactive imbalance therebetween, affecting either a net inductive or capacitive change in the load impedance presented to the oscillator. The center frequency of the circuit reacts in a substantially linear manner to the modulating voltage over the deviation bandwidth.

8 Claims, 9 Drawing Figures



[54] LOW FREQUENCY INERTIA BALANCED
DIPOLE HYDROPHONE

[75] Inventors: John H. Thompson, Severna Park;
George R. Douglas, Arnold, both of
Md.

[73] Assignee: Westinghouse Electric Corp.,
Pittsburgh, Pa.

[21] Appl. No.: 967,179

[22] Filed: Dec. 6, 1978

Related U.S. Application Data

[63] Continuation of Ser. No. 815,387, Jul. 13, 1977, abandoned.

[51] Int. Cl.² _____ H04B 13/00

[52] U.S. Cl. _____ 367, 471; 310/337;
367/174

[58] Field of Search _____ 340/8-14;
310/329, 330

[56]

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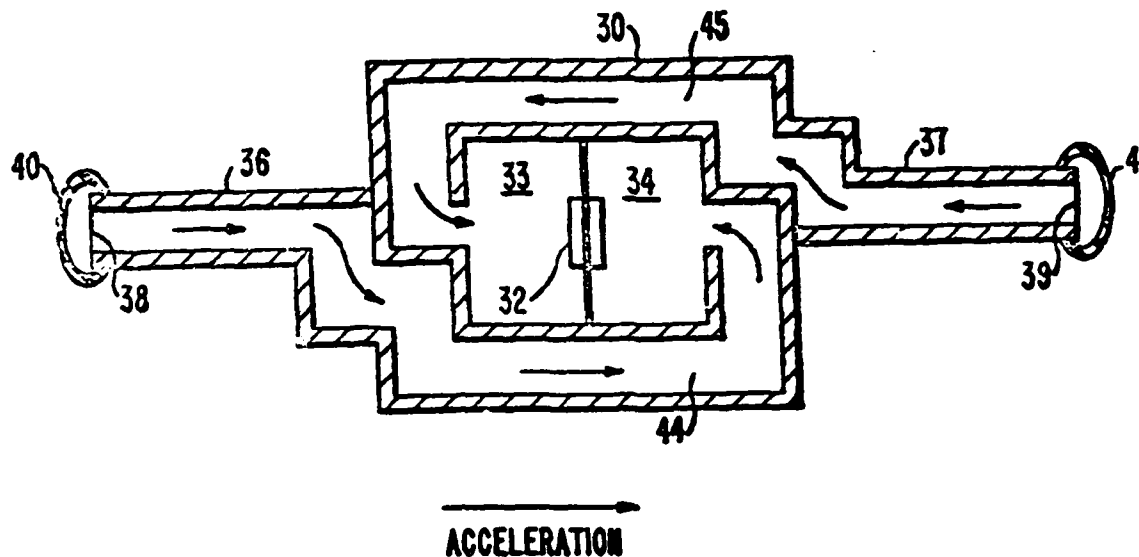
Primary Examiner—Harold J. Tudor
Attorney, Agent, or Firm—D. Schron

[57]

ABSTRACT

A dipole hydrophone having a differential pressure sensing unit, for example, a multi-laminar bender disc, within a liquid filled housing. Two liquid filled acoustic waveguides form extensions of the housing and include pressure sensing ports. A mass of predetermined value is connected to the sensing unit and with a predetermined separation between sensing ports, the mass value is chosen so that the sensing unit response to acceleration is very nearly equal and opposite to its response due to the inertial mass of the liquid.

16 Claims, 26 Drawing Figures



[54] SONIC DIRECTION SYSTEM

[75] Inventor: Roger G. Pridham, Providence, R.I.

[73] Assignee: Raytheon Company, Lexington, Mass.

[21] Appl. No.: 676,445

[22] Filed: Apr. 12, 1976

[51] Int. Cl. G01S 15/06

[52] U.S. Cl. 367/92; 367/105;

343/5 SA

[58] Field of Search 340/3 R, 3 A; 343/5 SA; 367/92, 105

[56] References Cited

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3,613,069	10/1971	Cary, Jr. et al.	367/92
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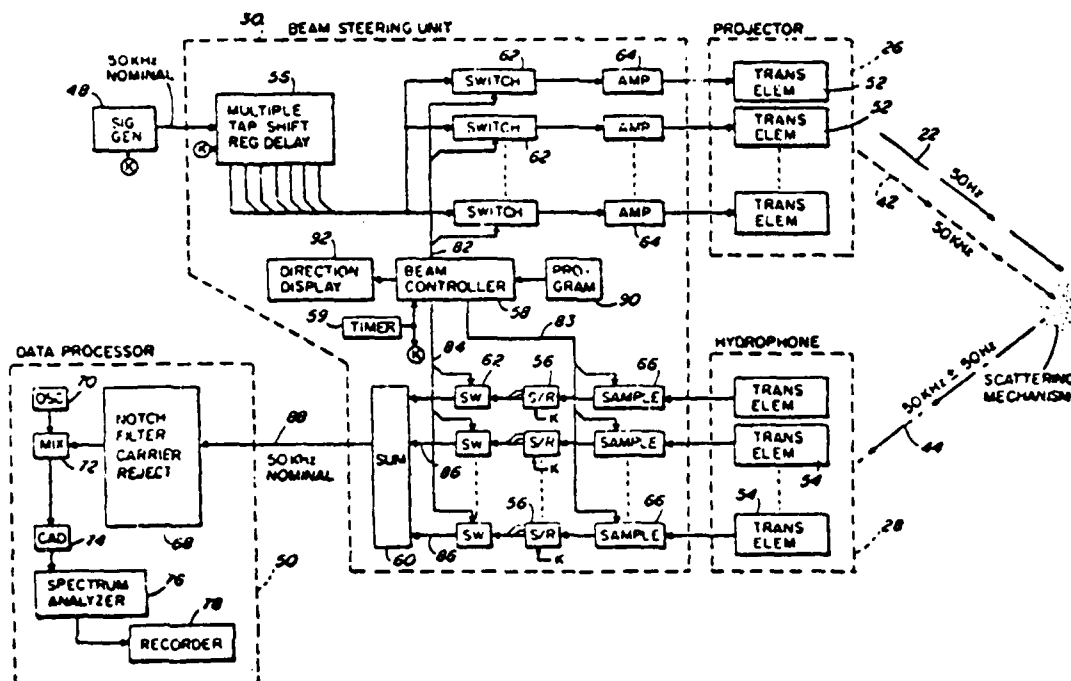
Bellin et al., *Journal of the Acoustical Society of America*, vol. 34, Aug. 1962, pp. 1051-1054.

Primary Examiner—Richard A. Farley
Attorney, Agent, or Firm—David M. Warren; Joseph D. Pannone; Milton D. Bartlett

[57] ABSTRACT

A system for the determination of the direction of a source of sound in water utilizing the finite amplitude effect. A narrow beam of sonic energy at a frequency higher than that of the source is projected in a direction opposite the direction of the source. A hydrophone receiving beam intercepts the projector beam at a distance from the projector thereof, the distance being sufficient to permit a finite amplitude non-linear interaction of the projector beam energy and the energy of the source via a virtual end-fire array. Cross-modulation products resulting from the non-linear interaction are received by the hydrophone, the precision of measurement being dependent on the directivity pattern of the virtual end-fire array.

5 Claims, 3 Drawing Figures



[54] RECEIVER CIRCUIT FOR AN ECHO-SOUNDING SYSTEM

[75] Inventor: Horst Schaefer, Kiel, Fed. Rep. of Germany

[73] Assignee: Honeywell Inc., Minneapolis, Minn.

[21] Appl. No.: 29,179

[22] Filed: Apr. 12, 1979

[51] Int. Cl.³ G01S 15/02

[52] U.S. Cl. 367/98

[58] Field of Search 367/97, 98

[56] References Cited

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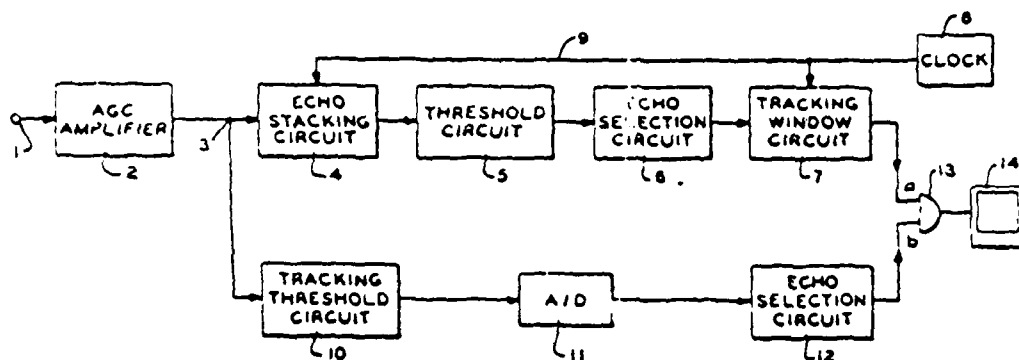
Primary Examiner—Richard A. Farley

Attorney, Agent, or Firm—Charles L. Rubow

[57] ABSTRACT

An echo-sounding receiver circuit comprising first and second receiver channels and an AND gate enabled by simultaneous outputs from both receiver channels is disclosed. The first receiver channel includes an echo stacking circuit, an echo selection circuit, and a tracking window circuit for establishing a measuring range or window whose timing is determined in part by detection of the first primary target echo in a sounding period and whose duration is established by the tracking window circuit. The second receiver channel includes a tracking threshold circuit and a second echo selection circuit for detecting the first echo that exceeds an amplitude determined by the amplitude of the preceding primary target echo. Upon detection of a primary echo by the second channel during the window established by the first channel, the AND gate supplies an output signal to a recording instrument or other utilization device.

4 Claims, 1 Drawing Figure



United States Patent [19]

Koppelman

[11] 4,280,202

[45] Jul. 21, 1981

[54] DIGITAL HOMODYNE PROCESSING SYSTEM

[75] Inventor: Roger F. Koppelman, Canton, Mich.

[73] Assignee: The Bendix Corporation, North Hollywood, Calif.

[21] Appl. No.: 89,930

[22] Filed: Oct. 31, 1979

[51] Int. Cl.³ G01S 15/02

[52] U.S. Cl. 367/87; 367/135; 343/5 NQ

[58] Field of Search 367/87, 99, 135, 131, 367/901; 343/5 NQ

[56] References Cited

U.S. PATENT DOCUMENTS

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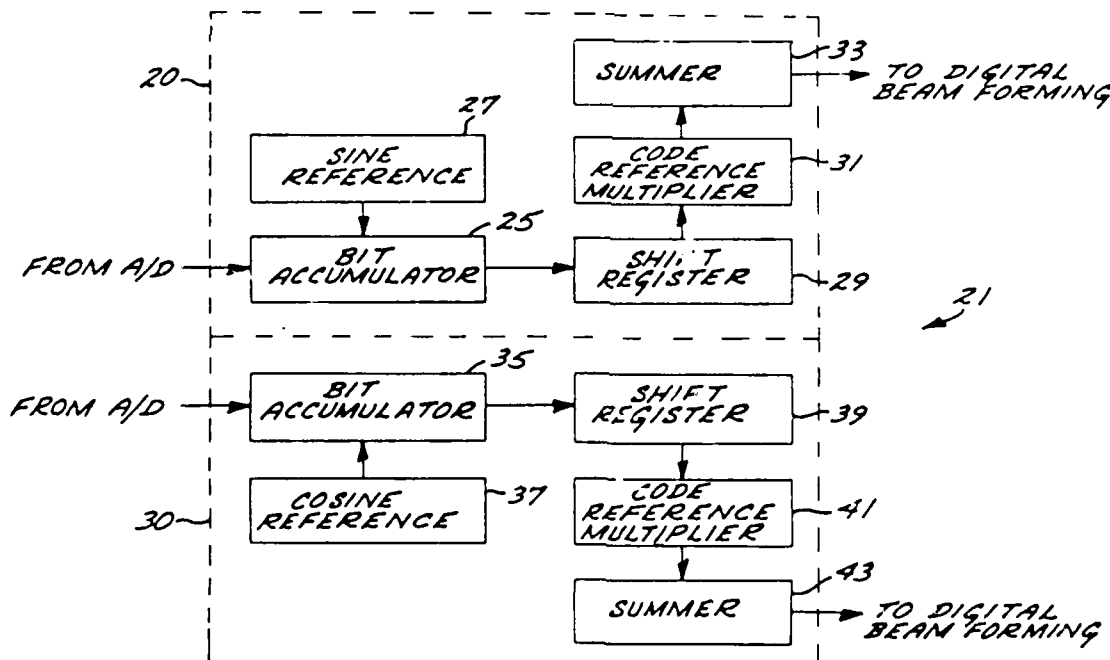
Primary Examiner—Richard A. Farley

Attorney, Agent, or Firm—Manuel Quiogue; Robert C. Smith

[57] ABSTRACT

A digital homodyne processing system is disclosed and includes a hydrophone, a preamplifier for amplifying the hydrophone output signal, a heterodyne circuit and a low-pass filter for filtering the amplified hydrophone output, and a digital-to-analog converter. The output of the digital-to-analog converter is compared against sine and cosine references and is integrated as a function of the sine and cosine references. The integration results are processed for detection of a coded waveform.

11 Claims, 2 Drawing Figures



United States Patent (19)

Suppa et al.

(11) 4,295,211

(45) Oct. 13, 1981

[54] INERTIALLY RELEASED JETTISONABLE AIRBORNE BUOY

[75] Inventors: Vito Suppa; Daniel Viallet, both of Paris, France

[73] Assignee: Thomson-CSF, Paris, France

[21] Appl. No.: 123,817

[22] Filed: Feb. 22, 1980

[30] Foreign Application Priority Data

Feb. 27, 1979 [FR] France 79 05002

[51] Int. Cl.³ H04B 1/59

[52] U.S. Cl. 367/4

[58] Field of Search 367/3, 4

[56] References Cited

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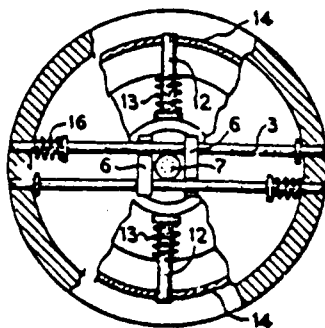
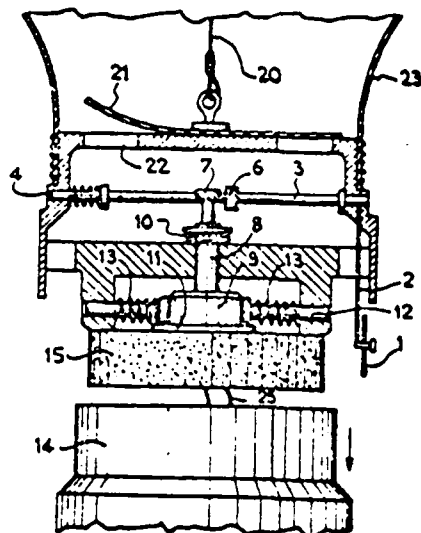
3,889,224 6/1975 Reed et al. 367/3
4,186,374 1/1980 Ouellette 367/4

Primary Examiner—Richard A. Farley
Attorney, Agent, or Firm—Cushman, Darby & Cushman

[57] ABSTRACT

A radio buoy which can be jettisoned from an aircraft by a cable and which is intended to float on the surface of the ocean connected to a submerged hydrophone. During the drop a balloon is inflated by a forced intake of air through holes as a result of articulated openings in the form of scoops, the scoops unlocking by a bar the protective casing of the balloon and the safety device of the container, which is detached after impact with the water, the submerged container being linked with the electronics by a cable. The buoy can be used for underwater monitoring at depths up to 2,000 meters.

7 Claims, 5 Drawing Figures



[54] FIBER OPTIC TRANSDUCER AND METHOD OF MANUFACTURE THEREFOR

[75] Inventor: Robert L. Gravel, Stow, Mass.

[73] Assignee: Sperry Corporation, New York, N.Y.

[21] Appl. No.: 71,893

[22] Filed: Sep. 4, 1979

[51] Int. Cl.³ G02B 5/14; G01L 9/00

[52] U.S. Cl. 350/96.10; 73/705

[58] Field of Search 350/96.10, 96.20, 96.29; 73/705; 250/227; 356/227

[56] References Cited

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loss Splices" in *Bell System Tech. Journal*, vol. 52, No. 9, Nov. 1973 pp. 1579-1588.

Primary Examiner—Stewart J. Levy

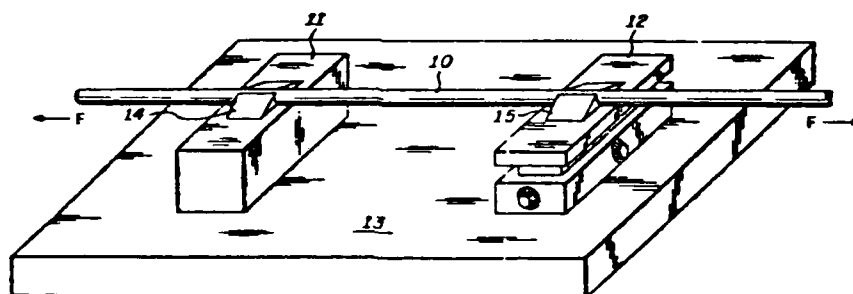
Attorney, Agent, or Firm—Howard P. Terry; Seymour Levine

[57]

ABSTRACT

An optical transducer for converting pressure variations to variations in amplitude of an optical signal. A first optical transmission line is positioned above a base in a manner to maintain its end face stationary while a second optical transmission line is positioned above the base in a manner to permit the axis to be displaced from the axis of the optical fiber with the stationary end face in accordance with variations of pressure applied thereto. Optical signals propagating in one of the optical transmission lines will couple to the other with a coupling factor dependent upon the axial displacement of the optical fibers. Under conditions of continuous pressure variations, such as that created by an incident acoustic wave, the coupled optical signal will be amplitude modulated in accordance with the pressure variations.

1 Claim, 3 Drawing Figures



[54] DIGITAL SONOBUOY

[75] Inventors: Paul R. Passmore, Dallas, Tex.; Elio Poggiagliomi, London, England

[73] Assignees: Refraction Technology, Inc., Dallas; Geoquest International Ltd., Houston, both of Tex.

[21] Appl. No.: 903,876

[22] Filed: May 8, 1978

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 773,528, Mar. 2, 1977, abandoned.

[51] Int. Cl.¹ G01V 1/22; G01V 1/38

[52] U.S. Cl. 367/3; 367/15; 367/77; 367/79; 328/162; 370/113

[58] Field of Search 340/15.5 TS, 7 R, 2; 178/69.1; 328/31, 32, 34, 115, 135, 162, 179/15 BL, 367/3, 15, 370/113; 367/77, 79

[56] References Cited

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4,042,906	8/1977	Ezell	340/15.5 TS

Primary Examiner—Howard A. Birmiel

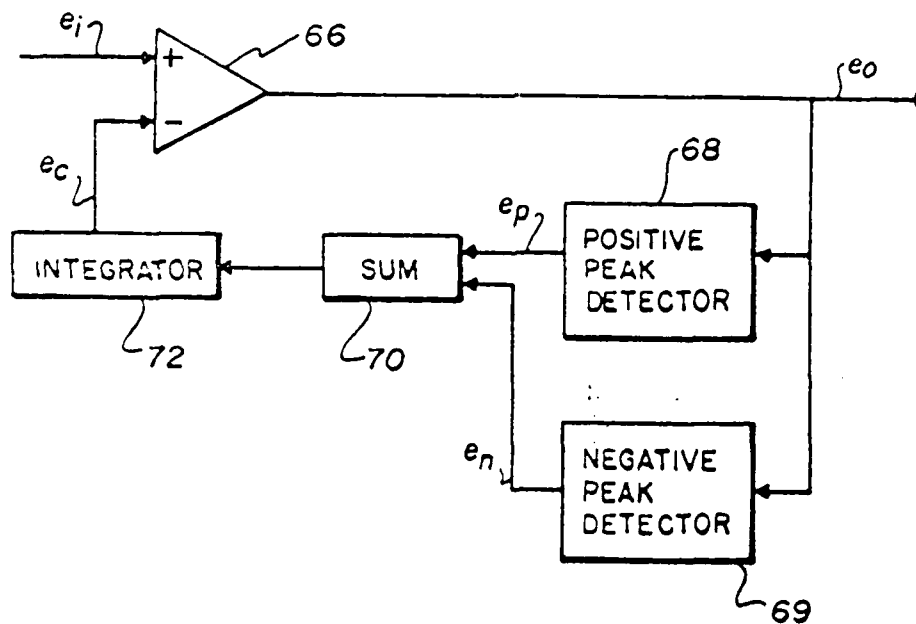
Attorney, Agent, or Firm—Kenneth R. Glaser

[57]

ABSTRACT

Disclosed is an underwater seismic exploration system utilizing a sonobuoy for the radio telemetry of seismic data signals to a remotely located receiver, the sonobuoy including circuitry for digitizing the analog signals generated by hydrophones suspended from the sonobuoy prior to the application of these signals to an RF antenna. The remotely located receiver includes an antenna for receiving the transmitted modulated digital signal information, and means for demodulating, demultiplexing, and appropriately converting the signals for either analog or digital recording of the received data.

5 Claims, 13 Drawing Figures



[54] ACOUSTIC VIBRATION SENSOR AND SENSING SYSTEM

[75] Inventor: Joseph L. Chovan, North Syracuse, N.Y.

[73] Assignee: General Electric Company, Syracuse, N.Y.

[21] Appl. No.: 108,861

[22] Filed: Dec. 31, 1979

[51] Int. Cl.³ H04R 1/44; G01B 9/02[52] U.S. Cl. 367/149; 73/657;
356/349; 367/140[58] Field of Search 367/140, 149; 356/349;
73/657

[56] References Cited

U.S. PATENT DOCUMENTS

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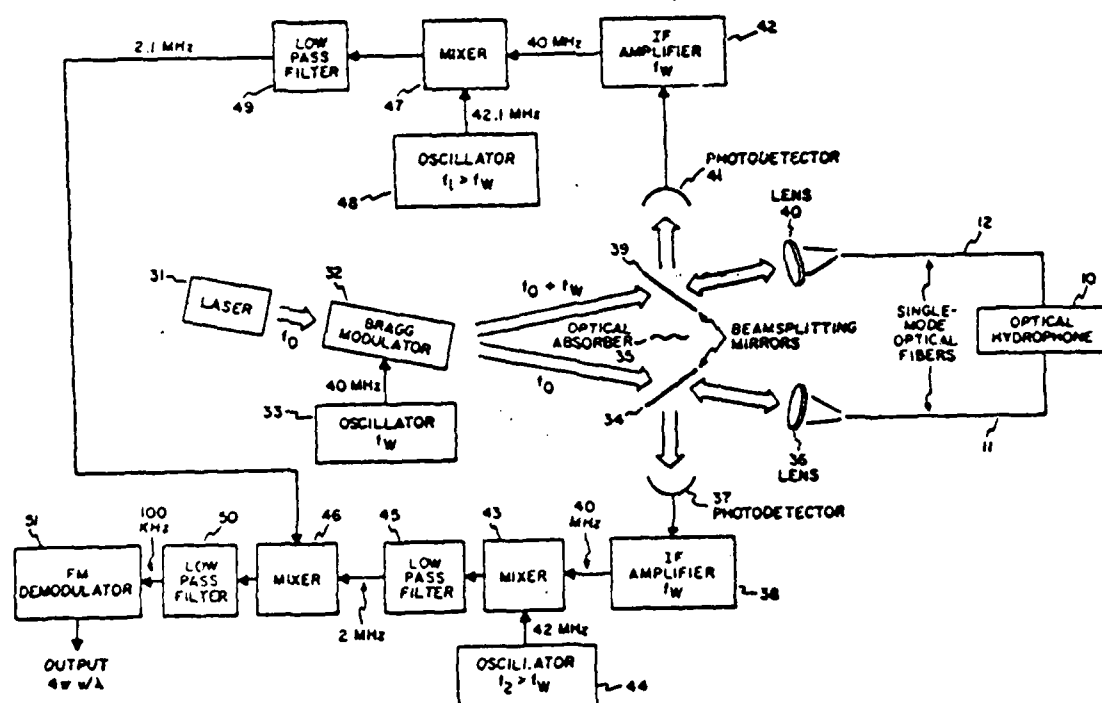
Primary Examiner—S. C. Buczinski

Attorney, Agent, or Firm—Richard V. Lang; Carl W. Baker

[57] ABSTRACT

A novel acoustic vibration sensor and novel acoustic vibration sensing system are described having principal application to hydrophones and operating upon the optical heterodyning principle. The sensor employs a pair of single mode fibers, optically coupled by a path whose length is varied by the acoustic vibrations, and including a partially reflecting discontinuity at the sensitive end of each fiber. Optical signals of one frequency are supplied to one fiber, and of another frequency to the other fiber. Optical signals of the same difference frequency emerge from the "dry end" of each fiber. When these two emergent signals are photodetected, and the phase or frequency difference is obtained, the acoustic vibration is sensed. The process effectively cancels out noise pickup in the single mode fibers and in other parts of the system, such as laser noise and oscillator instabilities.

10 Claims, 5 Drawing Figures



[54] ECHO RANGING PULSE DISCRIMINATION
CIRCUIT

[75] Inventor: Frederick K. Blades, Boulder, Colo.

[73] Assignee: PureCycle Corporation, Boulder,
Colo.

[21] Appl. No.: 165,254

[22] Filed: Jul. 2, 1980

[51] Int. Cl.³ G01S 15/04

[52] U.S. Cl. 367/98; 343/5 SM;
364/517; 367/900

[58] Field of Search 367/98, 900; 364/516,
364/517; 343/5 SM; 73/609

[56] References Cited

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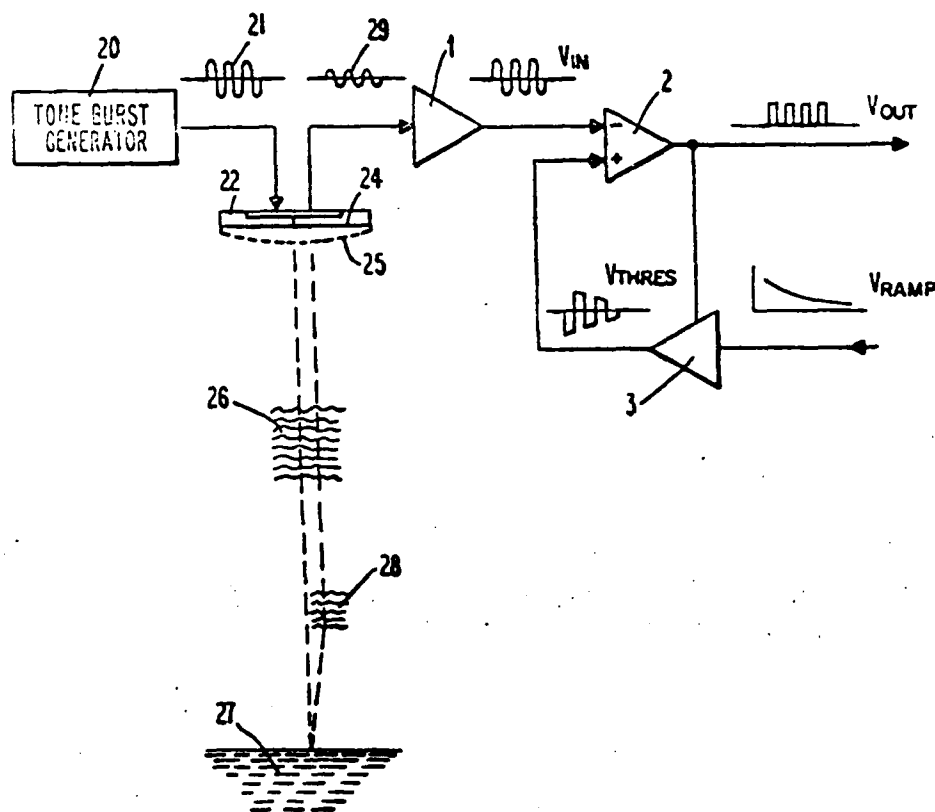
4,145,741 3/1979 Nappin 364/516
4,169,263 9/1979 Hooker, Jr. 343/5 SM

Primary Examiner—Richard A. Farley
Attorney, Agent, or Firm—Woodcock, Washburn,
Kurtz, Mackiewicz & Norris

[57] ABSTRACT

An improved echo ranging system is disclosed which features improved circuitry for discrimination of received reflected pulses from noise. Discrimination is performed by comparison of the input pulses to a time-varying threshold voltage wherein the threshold function varies in accordance with the predicted attenuation of the transmitted echo signal over its path. In this way, variable gain elements used to amplify the received signal prior to comparison it with a fixed threshold height can be eliminated, thus rendering the circuitry less complicated, expensive, and calibration free.

6 Claims, 6 Drawing Figures



United States Patent [19]

Butler

[11] 4,326,275

[45] Apr. 20, 1982

[54] DIRECTIONAL TRANSDUCER

[75] Inventor: John L. Butler, Marshfield, Mass.

[73] Assignee: Hazeltine Corporation, Greenlawn, N.Y.

[21] Appl. No.: 79,768

[22] Filed: Sep. 27, 1979

[51] Int. Cl.³ H04B 17/00

[52] U.S. Cl. 367/160; 367/165;
367/166; 367/173; 310/329

[58] Field of Search 367/158, 160, 161, 163,
367/165, 166, 171, 173, 174; 310/329

[56] References Cited

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3,893,342	7/1975	Florian et al.	310/329
4,015,233	3/1977	Laurent et al.	367/165

Primary Examiner—Harold J. Tudor

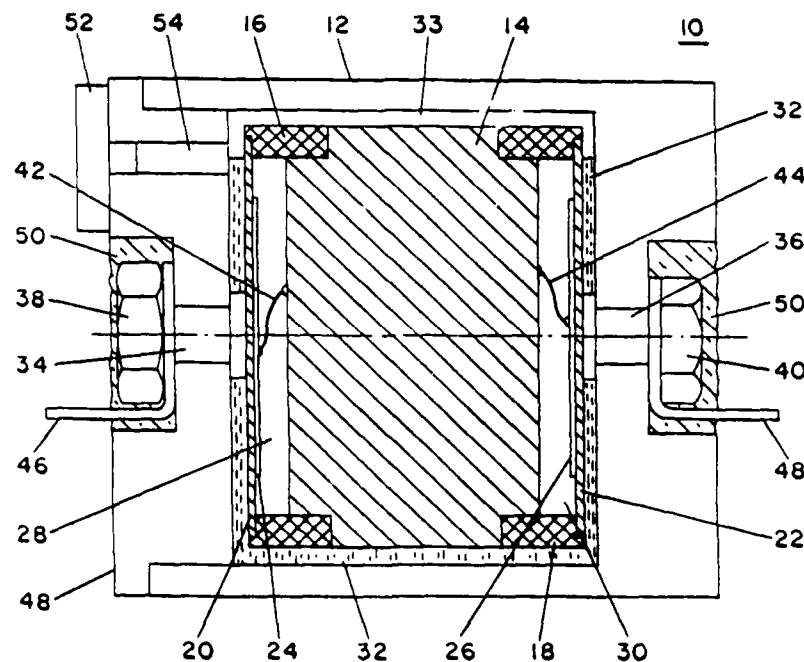
Attorney, Agent, or Firm—E. A. Onders; F. R. Agovino

[57]

ABSTRACT

A directional transducer is disclosed which includes flexural disc transducer elements mounted by their periphery to an inertial mass and connected to the transducer housing by their centers.

10 Claims, 2 Drawing Figures



[54] A/D, D/A CONVERTER FOR PCM TRANSMISSION SYSTEM

[75] Inventors: Masao Yamasawa, Sagami-hara; Michinobu Ohhata, Kawasaki; Toshitake Ikezawa, Yokohama, all of Japan

[73] Assignee: Fujitsu Limited, Kawasaki, Japan

[21] Appl. No.: 152,556

[22] Filed: May 23, 1980

[30] Foreign Application Priority Data

May 30, 1979 [JP] Japan 54-66121

[51] Int. Cl.³ H04L 7/04

[52] U.S. Cl. 375/8; 370/100; 375/25; 375/120

[58] Field of Search 375/8, 25, 120, 119, 375/118; 370/100

[56]

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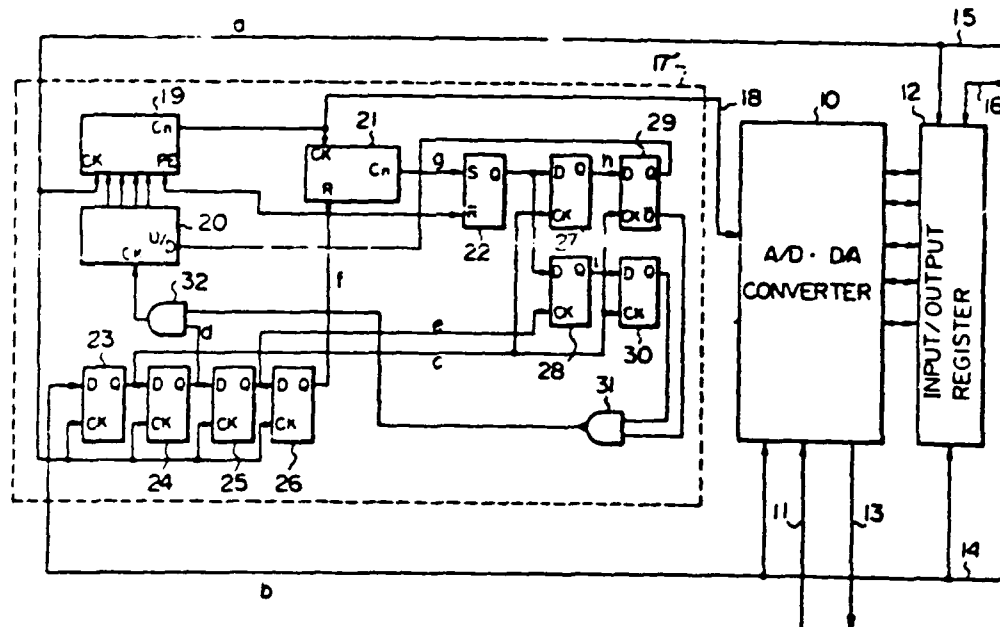
Primary Examiner—Glen R. Swann, III

[57]

ABSTRACT

A codec, utilized for an PCM transmission system, has an a/d and d/a converter, and a digital phase locked loop circuit. The digital phase locked loop circuit generates internal operation clocks, which are used for the a/d and d/a converting operations, by dividing the frequency of the applied external clocks by a value determined in accordance with the frequency ratio between frame pulses and the external clocks.

9 Claims, 3 Drawing Figures



[54] ULTRASONIC ARRAY

[75] Inventors: Bertram Sachs, Erlangen; Jacques Borburgh, Poxdorf, Ingmar Feigt, Erlangen, all of Fed. Rep. of Germany

[73] Assignee: Siemens Aktiengesellschaft, Berlin & Munich, Fed. Rep. of Germany

[21] Appl. No.: 238,938

[22] Filed: Feb. 27, 1981

[30] Foreign Application Priority Data

Mar. 17, 1980 [DE] Fed. Rep. of Germany 3010210

[51] Int. Cl.¹ G01S 7/52

[52] U.S. Cl. 367/105; 73/626; 367/122

[58] Field of Search 367/105, 122, 7, 8, 367/138; 73/626

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Primary Examiner—Richard A. Farley

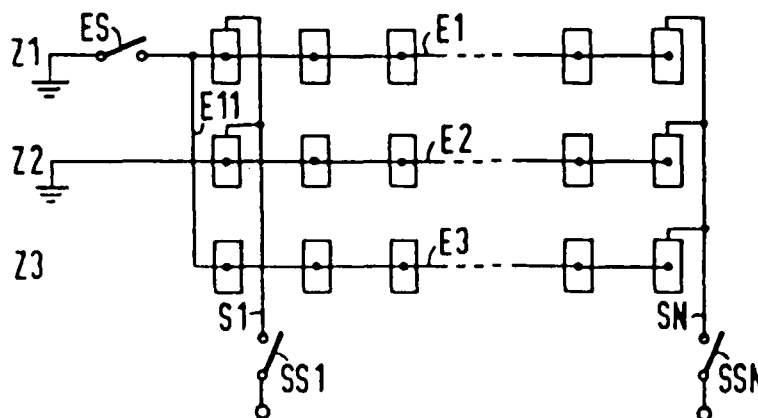
Attorney, Agent, or Firm—Hill, Van Santen, Steadman, Chiara & Simpson

[57]

ABSTRACT

In an exemplary embodiment, the transducer elements are arranged in rows and columns, the transducer elements being contacted at both sides by oppositely disposed contact surfaces, and switches being associated with the contacts of the one contact surface as well as with the contacts of the other contact surface for the purpose of adjustment of preselectable transmitting and/or receiving surface of transducer elements during a transmitting/receiving cycle, in particular, for the purpose of dynamic focusing. It is an object of the disclosure to construct an ultrasonic array which can function with an optimally low outlay of switches and which if desired also permits a transition to continuously varied apertures. In accordance with the disclosure, this object is achieved in that transducer elements, with their one contact surface in the direction of the rows, and with their other contact surface in direction of the columns, are contacted together into groups, and that there is maximally associated, with each row group, an individual common row group switch, and that there is maximally associated, with each column group, an individual common column group switch. A transfer to continuously variable aperture is possible in the simplest manner if continuously variable switching elements, such as controllable resistances, or the like, are utilized as transmitting and/or receiving switches.

13 Claims, 6 Drawing Figures



[54] SHOCK-HARDENED, HIGH PRESSURE
CERAMIC SONAR TRANSDUCER[75] Inventor: Gordon L. Snow, Salt Lake City,
Utah[73] Assignee: Edo Western Corporation, Salt Lake
City, Utah

[21] Appl. No.: 140,156

[22] Filed: Apr. 14, 1980

[51] Int. Cl.³ H04R 17/00[52] U.S. Cl. 367/152; 367/155;
367/166; 367/167; 367/162; 367/171[58] Field of Search 367/152, 153, 155, 157,
367/158, 165, 166, 167, 171, 172, 173, 162, 163,
174, 176; 310/337

[56] References Cited

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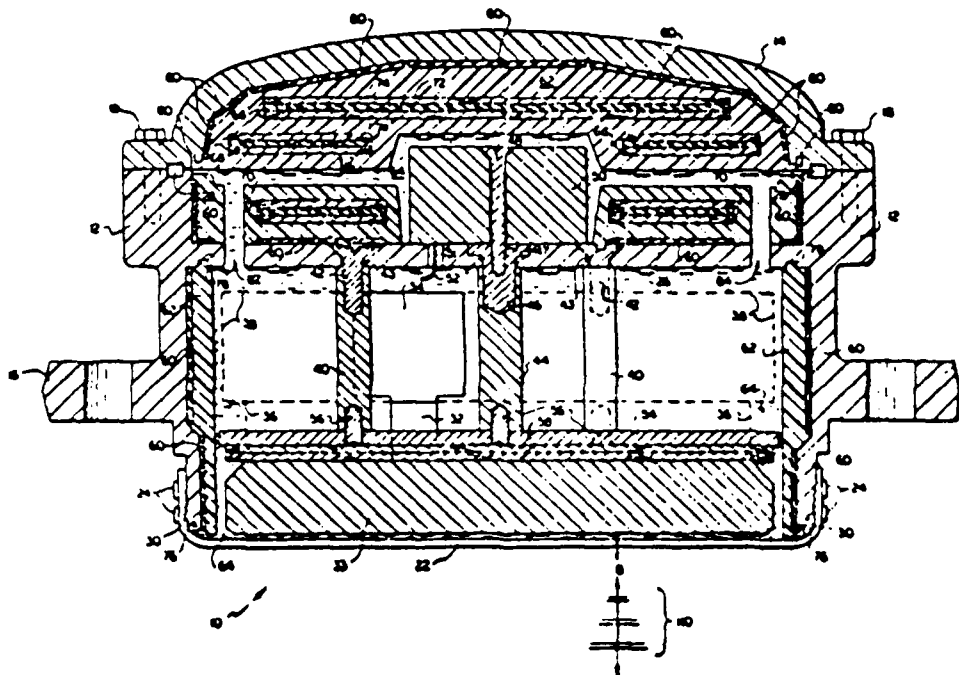
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Primary Examiner—Harold J. Tudor
Attorney, Agent, or Firm—Thorpe, North & Western

[57] ABSTRACT

A sonar transducer especially adapted for use when subjected to high hydrostatic pressures and extreme mechanical and explosive shock. The sonar transducer includes a conventional casing, ruggedized to withstand high pressures and a hostile environment. The casing is closed on all sides but one. An array of piezoelectric ceramic stacks are suspended inside of the casing and sandwiched between a single front mass and individual rear masses. The single front mass is positioned closest to the open side of the casing. A flexible cover is sealed over the open side of the casing and pressurized oil is placed inside the housing. Appropriate channels are provided to enable the oil to freely flow throughout the interior of the unit, including flowing inside of and about the ceramic stacks. Electrical connections are made with the ceramic stacks to allow external voltages to electrically stress the stacks, and also to allow external sensing of the voltages generated when the stacks are mechanically stressed. Appropriate lining material and filler material, as well as baffle plates, are selectively placed within the housing in order to impart a desired directivity pattern to the sound energy associated with the transducer's performance.

18 Claims, 6 Drawing Figures



[19]

Beauducel et al.

544

[45]

- [54] **DEVICE FOR DETERMINING THE INSTANT OF RECEPTION OF AN ACOUSTIC WAVE**
- [75] **Inventors:** Claude Beauducel, Henouville; Jacques Cretin, Le Chesnay, both of France
- [73] **Assignees:** Institut Francais du Petrole, Rueil-Malmaison; Compagnie Generale de Geophysique, Massy, both of France

- [21] Appl. No.: 184,496

- [22] Filed: Sep. 5, 1980

- [30] Foreign Application Priority Data

Sep. 5, 1979 [FR] France 79 22364

- [51] Int. Cl.³ G01V 1/28; G01V 1/38
[52] U.S. Cl. 367/21; 367/27;
 367/55; 370/85
[58] Field of Search 367/15, 21, 26, 27,
 367/55, 78, 79; 370/85

- [56]
- References Cited**

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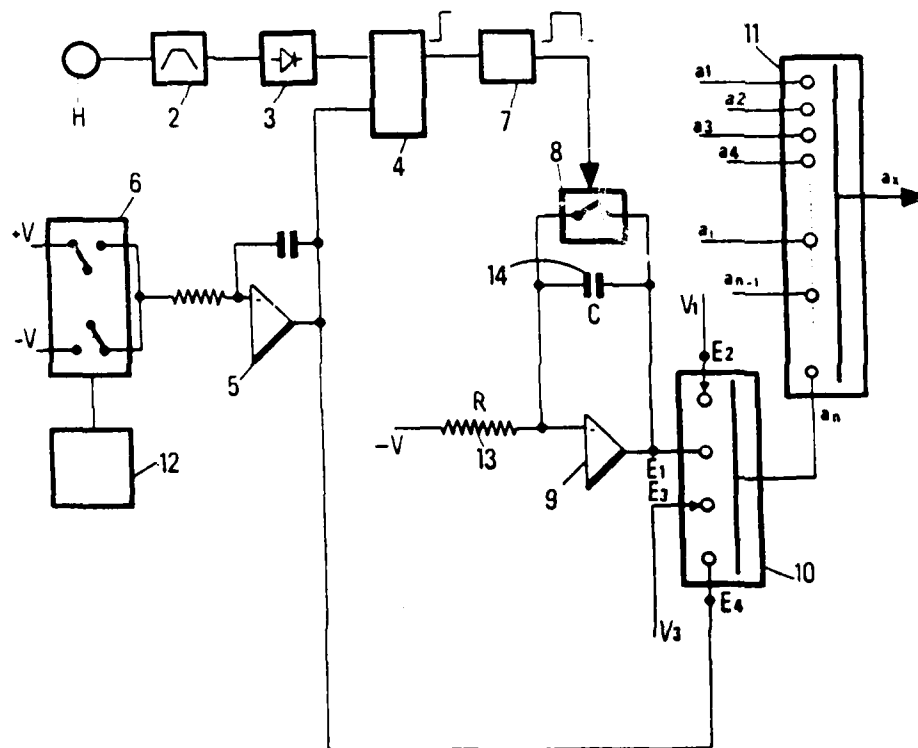
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Primary Examiner—Nelson Moskowitz
Attorney, Agent, or Firm—Millen & White

[57] **ABSTRACT**

A device for the sequential transmission of information elements from a sensor arrangement receiving acoustic waves at different locations and a system for recording or processing these information elements. The device includes means for generating information signals representative of the instant of reception at one of said sensor means of a directly transmitted acoustic wave emanating from a source, in the form of at least two discrete values of a continuously varying voltage which begins to be generated at the instant of reception of the direct wave, and means for determining the instant of reception from said discrete values are provided, after their transmission to the recording or processing system by a sequential transmission of the discrete values.

12 Claims, 4 Drawing Figures



[54] **DIGITAL SIGNAL RECEIVER WITH FM INTERFERENCE ELIMINATION CAPABILITY**

[75] Inventor: Junji Namiki, Tokyo, Japan

[73] Assignee: Nippon Electric Co., Ltd., Tokyo, Japan

[21] Appl. No.: 257,234

[22] Filed: Apr. 24, 1981

[30] **Foreign Application Priority Data**

May 21, 1980 [JP] Japan 55-67593
May 21, 1980 [JP] Japan 55-67594

[51] Int. Cl.³ H04L 1/00

[52] U.S. Cl. 375/102; 371/41;
455/206; 455/305

[58] Field of Search 371/2, 30, 37, 41, 72;
328/162, 164, 165; 375/58, 99, 101, 102;
455/63, 65, 296, 303, 305, 312, 206

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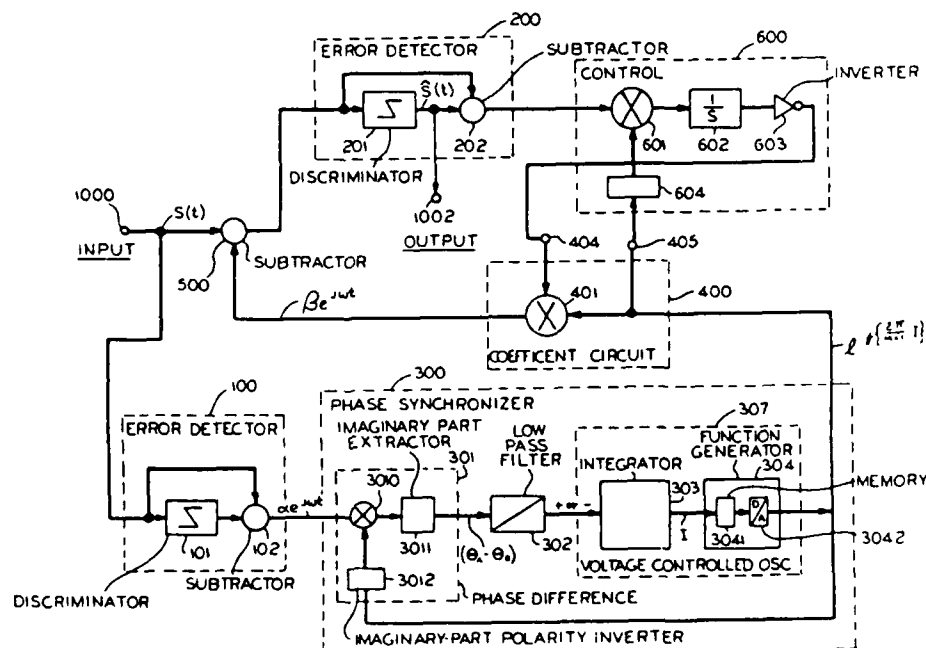
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3,613,077 10/1971 Forney, Jr. 371/30

Primary Examiner—Benedict V. Safourek
Attorney, Agent, or Firm—Laff, Whitesel, Conte & Saret

[57] **ABSTRACT**

The invention eliminates an FM interference from a digital signal when the interference occurs because the FM and digital signals are transmitted over adjacent routes and sharing a common frequency band. An error detector finds a difference between a detected baseband digital signal and an assumed transmission code, which is taken from the baseband signal. The detector produces a first error signal responsive thereto. A phase synchronizing circuit produces an output signal synchronized with the first error signal. A coefficient circuit multiplies the output of the synchronizing circuit by a complex coefficient which is then subtracted from the baseband signal. A second error detector produces a second error signal responsive to the difference between the output of the subtractor and a discriminated transmission code. Responsive thereto to a control circuit varies the complex coefficient to produce an output which is the original baseband signal, free of the FM interference.

9 Claims, 4 Drawing Figures



[54] **STABILIZED SUSPENSION SYSTEM**

[75] Inventors: John Cupolo, Bristol; David J. Salisbury, Barrington; Charles W. Ouellette, Portsmouth, all of R.I.

[73] Assignee: Raytheon Company, Lexington, Mass.

[21] Appl. No.: 249,264

[22] Filed: Mar. 30, 1981

Related U.S. Application Data

[60] Continuation of Ser. No. 63,626, Aug. 3, 1979, abandoned, which is a division of Ser. No. 939,562, Sep. 5, 1978, Pat. No. 4,186,370.

[51] Int. Cl.³ B63B 21/52

[52] U.S. Cl. 441/22

[58] Field of Search 367/3, 4, 130; 114/244, 114/245, 126, 311; 244/138 A; 441/21, 22, 23, 24, 25, 26, 27

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Primary Examiner—Sherman D. Basinger

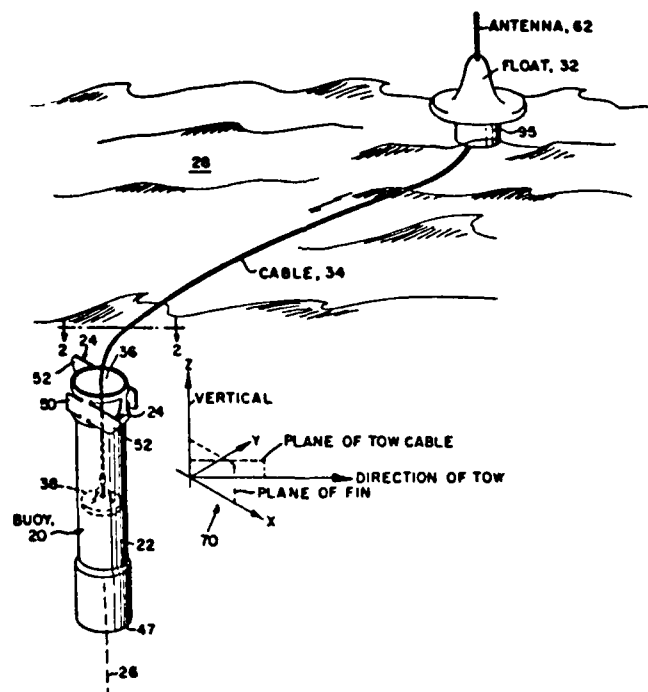
Attorney, Agent, or Firm—Martin M. Santa; Joseph D. Pannone

[57]

ABSTRACT

A suspension system for an air-dropped sonobuoy includes a transducer housing wherein the upper portion is emptied upon deployment of a float. The weight distribution of the transducer and housing provide for a center of mass and a center of buoyancy at a location beneath a pivot in the upper portion of the housing. A suspension line connects the pivot with the float, and a pair of opposed extensible fins at the top of the housing locate the center of hydrodynamic pressure at the pivot. Thereby, the housing is maintained in a stabilized vertical attitude during descent through the water and during deployment at a predetermined depth independently of a difference in velocity of fluid movement at the float and at the sonobuoy.

8 Claims, 6 Drawing Figures



[54] PHOTOELECTROCHEMICAL CELL

[75] Inventors: **R. David Rauh**, Newton; **Robert A. Boudreau**, Norton, both of Mass.[73] Assignee: **EIC Laboratories, Inc.**, Newton, Mass.[21] Appl. No.: **280,450**[22] Filed: **Jul. 6, 1981**[51] Int. Cl.³ **H01M 6/36**[52] U.S. Cl. **429/111**[58] Field of Search **429/111**[56] **References Cited****U.S. PATENT DOCUMENTS**

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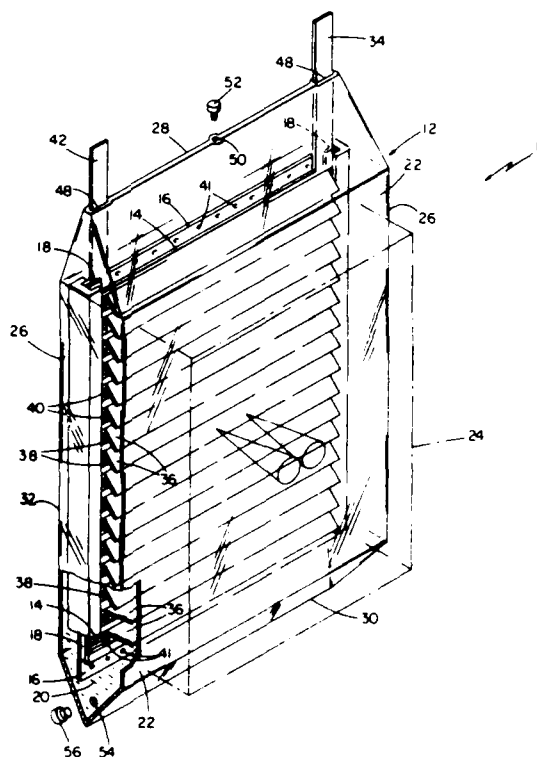
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Primary Examiner—Aaron Weisstuch

[57]

ABSTRACT

A photoelectrochemical cell comprising a sealed container having a light-transmitting window for admitting light into the container across a light-admitting plane, an electrolyte in the container, a photoelectrode in the container having a light-absorbing surface arranged to receive light from the window and in contact with the electrolyte, the surface having a plurality of spaced portions oblique to the plane, each portion having dimensions at least an order of magnitude larger than the maximum wavelength of incident sunlight, the total surface area of the surface being larger than the area of the plane bounded by the container, and a counter electrode in the container in contact with the electrolyte.

5 Claims, 4 Drawing Figures

[54] ACOUSTICALLY FILTERED TRANSDUCER

[75] Inventor: Harry Nadler, Thousand Oaks, Calif.

[73] Assignee: Rockwell International Corporation,
El Segundo, Calif.

[21] Appl. No.: 257,840

[22] Filed: Apr. 27, 1981

[51] Int. Cl.³ H04R 1/28; H04R 17/10

[52] U.S. Cl. 367/140; 181/140;
367/149; 367/162; 367/176; 73/648

[58] Field of Search 367/13, 140, 149, 162,
367/163, 167, 172, 174, 176, 189; 310/322;
181/113, 160, 182, 122, 139, 140; 73/579, 648,
649

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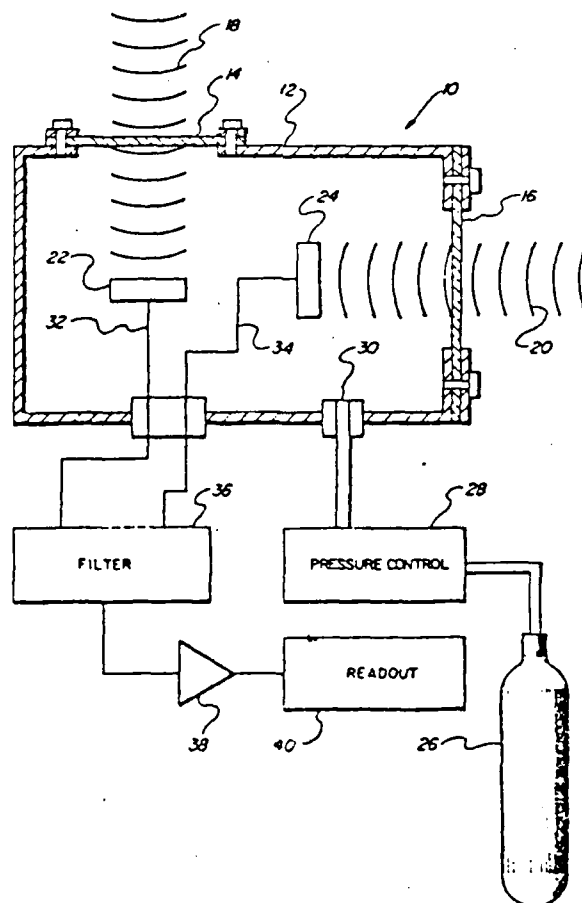
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Primary Examiner—Richard A. Farley
Attorney, Agent, or Firm—H. Fredrick Hamann; Craig
O. Malin; John J. Deinken

[57] ABSTRACT

Disclosed is an acoustic transducer which includes a pressure tight vessel with a window in the vessel which is transparent to acoustic wave energy. A gas is disposed within the vessel, while an electromechanical transducer is located within the vessel at an antinode for a resonant wave of the gas. A port communicates with the interior of the vessel, with a pressure control coupled to the port and to a source of the gas for controlling the pressure of the fluid within the vessel.

6 Claims, 3 Drawing Figures



[54] AIR ELECTRODE

[75] Inventors: Tsutomu Takamura, Yokohama;
Yuichi Sato, Atsugi; Toshiaki
Nakamura, Yono; Nobukazu Suzuki,
Tokyo, all of Japan

[73] Assignee: Tokyo Shibaura Denki Kabushiki
Kaisha, Kawasaki, Japan

[21] Appl. No.: 325,753

[22] Filed: Nov. 30, 1981

[30] Foreign Application Priority Data

Dec. 23, 1980 [JP] Japan 55-181394

[51] Int. Cl.³ H01M 4/90; H01M 4/96

[52] U.S. Cl. 429/42; 429/43

[58] Field of Search 429/42, 43

[56] References Cited

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4,341,848 7/1982 Liu et al. 429/42

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2404312 5/1979 France 429/42

Primary Examiner—Donald L. Walton

Attorney, Agent, or Firm—Schwartz, Jeffery, Schwaab,
Mack, Blumenthal & Koch

[57]

ABSTRACT

An air electrode to be used for carrying out electrochemical reduction of an oxygen gas, which comprises an electrode body composed of a porous body and a fluorine-containing solvent incorporated therein. The air electrode is suitable for use in a hydrogen/oxygen fuel cell, a metal/air cell or an oxygen sensor.

18 Claims, No Drawings

[54] SPEECH DIGITIZATION SYSTEM

[75] Inventor: Richard T. Gagnon, Rochester, Mich.

[73] Assignee: Federal Screw Works, Detroit, Mich.

[21] Appl. No.: 338,521

[22] Filed: Jan. 17, 1982

Related U.S. Application Data

[63] Continuation of Ser. No. 880,996, Feb. 24, 1978, abandoned

[51] Int. Cl.³ H03K 13/05[52] U.S. Cl. 340/347 R; 340/347 AD;
340/347 DA; 375/30; 332/11 D[58] Field of Search 340/347 AD, 347 CC,
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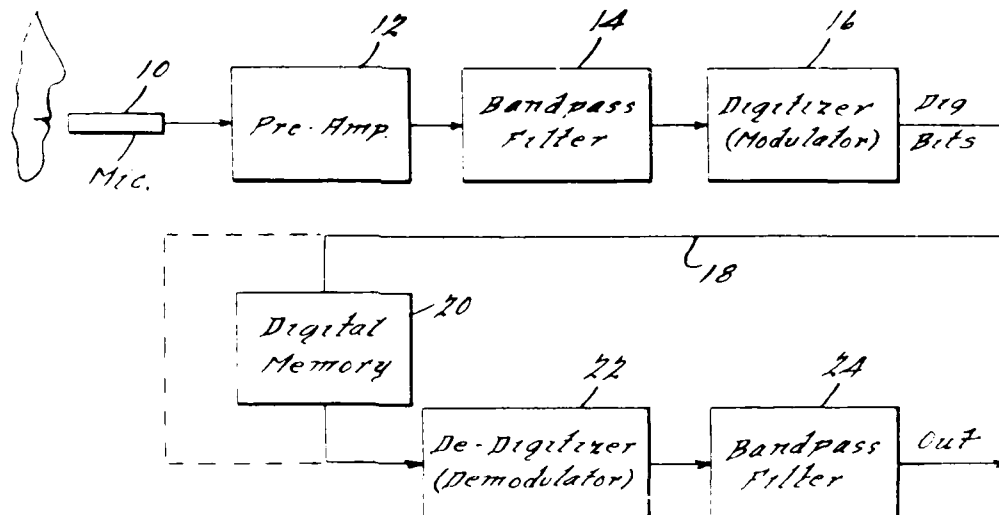
Primary Examiner—T. J. Sloyan

Attorney, Agent, or Firm—Harness, Dickey & Pierce

[57] ABSTRACT

A speech digitization system including novel encoder and decoder circuits that minimizes the number of resolution bits required to produce a given level of speech quality by optimizing the information content of the digital output signal from the encoder. This is accomplished by providing a companded speech digitization system that includes an amplitude function generator which is adapted to produce an amplitude function signal that maintains substantial duty cycles on the digital output signal over the entire audio amplitude range. Included in the novel amplitude function generator is a unique bias network that serves to center the duty cycle swing of the digital output signal from the encoder around 50% where the information content of the signal is statistically maximized.

13 Claims, 5 Drawing Figures



[54] FIBER OPTIC TRANSDUCER

[75] Inventor: Donald H. McMahon, Carlisle, Mass.

[73] Assignee: Sperry Corporation, New York, N.Y.

[21] Appl. No.: 286,812

[22] Filed: Jul. 27, 1981

Related U.S. Application Data

[63] Continuation of Ser. No. 63,504, Aug. 3, 1979, abandoned.

[51] Int. Cl.³ G02B 5/14; G01D 5/34[52] U.S. Cl. 350/96.29; 250/227;
250/231 P[58] Field of Search 350/96.29, 96.15, 96.16;
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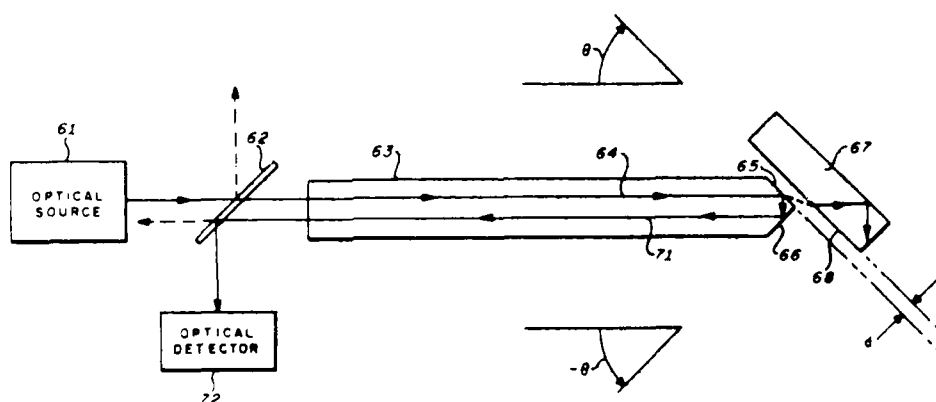
Primary Examiner—John K. Corbin

Assistant Examiner—Rodney B. Bovernick
Attorney, Agent, or Firm—Howard P. Terry; Seymour Levine

[57] ABSTRACT

A fiber optic transducer is provided by cutting and polishing the ends of two optical fibers, having equal indexes of refraction, at angles with respect to their axis such that all light signals propagating within the optical fibers are incident to the end face at angles that are greater than the critical angle defined for an interface between a medium with an index of refraction equal to the index of refraction equal to that of an intervening medium between the two fibers. The two end faces so cut are positioned to be in a parallel relationship, a distance apart that is less than the wavelength of the light propagating within the input fibers. Variations of this distance with the pressure changes caused by the acoustic environment produces variations in the optical signal energy coupled from the input optical fiber to the output optical fiber, thus creating an amplitude modulated light beam that propagates in the output optical fiber.

7 Claims, 4 Drawing Figures



[54] CORRELATION SYSTEM FOR GLOBAL POSITION RECEIVER

[75] Inventor: George Gorski-Popiel, Chelmsford, Mass.

[73] Assignee: Massachusetts Institute of Technology, Cambridge, Mass.

[21] Appl. No.: 266,679

[22] Filed: May 22, 1981

[51] Int. Cl.³ H04K 1/04

[52] U.S. Cl. 375/96; 375/115; 370/107

[58] Field of Search 375/94, 96, 115; 370/18, 106, 107; 364/604, 728, 819

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Primary Examiner—Benedict V. Safourek

Assistant Examiner—Stephen Chin

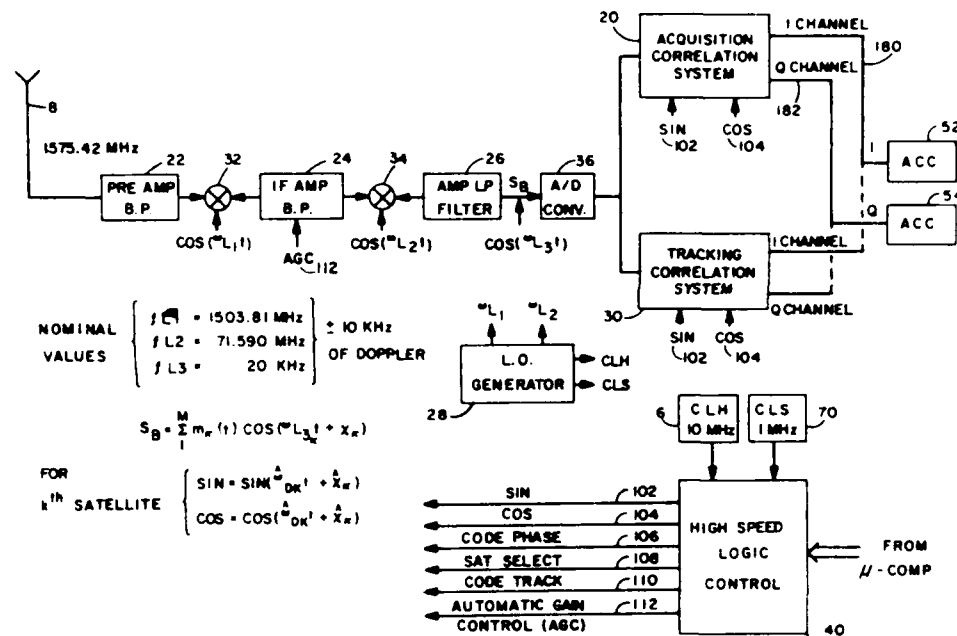
Attorney, Agent, or Firm—Arthur A. Smith, Jr.; Thomas J. Engellenner

[57]

ABSTRACT

A digital receiver for receiving and interpreting navigational data in the global position system comprising faster-than-real-time correlators for correlating the code portions of individual signals with matching codes stored in memory thus creating a plurality of virtual channels for acquiring and tracking each visible satellite.

7 Claims, 10 Drawing Figures



[54] **FIBER OPTIC HYDROPHONE
TRANSDUCERS**

[75] Inventor: Jon H. Myer, Woodland Hills, Calif.

[73] Assignee: Hughes Aircraft Company, El
Segundo, Calif.

[21] Appl. No.: 332,791

[22] Filed: Dec. 21, 1981

[51] Int. Cl.³ H04R 17/00

[52] U.S. Cl. 367/149; 367/140;
350/96.29; 350/96.21

[58] Field of Search 367/140, 141, 149;
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Optical Fibers", *Applied Physics Letters*, vol. 29, No. 8, Oct. 1976.

Primary Examiner—Harold J. Tudor

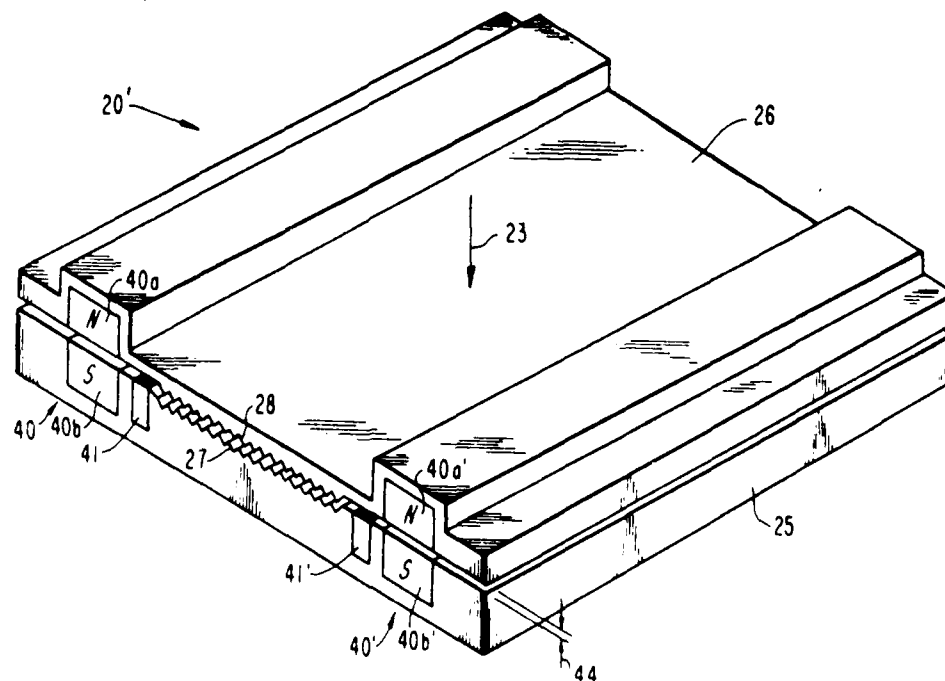
Assistant Examiner—Tyrone Davis

Attorney, Agent, or Firm—Russell Ben Miller; William J. Bethurum; Anthony W. Karambelas

[57] **ABSTRACT**

Apparatus is provided including a light source, a transducer and a detector, which is capable of detecting applied acoustic signals. The transducer employs first and second ridged members which have parallel rippled surfaces which contact opposite sides of a fiber optic waveguide. Each rippled surface has a different predetermined ripple pitch which provides for variable sensitivity along one dimension of the transducer. Modulation of the position of the ridged members relative to one another by means of applied acoustic signals causes microbend attenuation of light transmitted through the waveguide. The modulation of the light provides an indication of the presence of the acoustic signals. The variation in dimensional sensitivity provided by the transducer allows for a determination of the direction of arrival of the acoustic signals. Appropriate selection of pitch and pitch ratio of the two rippled surfaces provides any desired spatial sensitivity distribution of the hydrophone. A transducer is also disclosed which further incorporates magnetic elements to provide a mechanical prestress bias to the waveguide, thus providing a frictionless and hysteresis-free device.

12 Claims, 4 Drawing Figures



United States Patent [19]

Annis

[11] Patent Number: 4,474,685

[45] Date of Patent: Oct. 2, 1984

[54] HIGH PERFORMANCE MOLDING
COMPOUNDS FOR SHIELDING
ELECTROMAGNETIC INTERFERENCE

[75] Inventor: Myron C. Annis, North Tonawanda,
N.Y.

[73] Assignee: Occidental Chemical Corporation,
Niagara Falls, N.Y.

[21] Appl. No.: 363,322

[22] Filed: Mar. 29, 1982

[51] Int. Cl.³ H01B 1/02

[52] U.S. Cl. 252/503; 252/506;
252/511; 524/439; 524/440; 524/441; 524/495;
523/137; 523/451; 523/457; 523/458; 523/459;
523/468; 523/440; 523/512; 523/513; 264/104;
264/105

[58] Field of Search 252/502, 503, 506, 511;
524/439, 440, 441, 495, 496, 414; 264/104, 105;
523/137, 451, 457, 458, 459, 468, 440, 512, 513

[56] References Cited

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Primary Examiner—Josephine L. Barr

Attorney, Agent, or Firm—James F. Tao; James F. Mudd

[57] ABSTRACT

High shielding efficiencies to emissions of electromagnetic interference are achieved with molding compositions comprised of thermosetting resins and a multi-component electroconductive filler system. Compounds having a combination of at least two conductive fillers provide shielding efficiencies of 30 dB of attenuation or more to electromagnetic emissions over a frequency range of 0.5 to 1000 Mhz without adversely affecting mechanical properties and processing capabilities.

23 Claims, 3 Drawing Figures

[54] HYBRID INTEGRATED CIRCUIT
COMPONENT AND PRINTED CIRCUIT
BOARD MOUNTING SAID COMPONENT

- [75] Inventors: Tsuneshi Nakamura, Hirakata;
Tatsuro Kibuchi, Kyoto, both of
Japan
- [73] Assignee: Matsushita Electric Industrial Co.,
Ltd., Osaka, Japan
- [21] Appl. No.: 377,997
- [22] Filed: May 13, 1982

[30] Foreign Application Priority Data

May 18, 1981 [JP] Japan 56-74689

- [51] Int. Cl.³ H05K 1/14; H05K 3/40
- [52] U.S. Cl. 361/398; 29/837;
29/839; 361/412; 361/413; 361/388
- [58] Field of Search 361/397, 398, 412, 413,
361/415, 388, 395; 29/830, 831, 835, 837, 838,
839, 845

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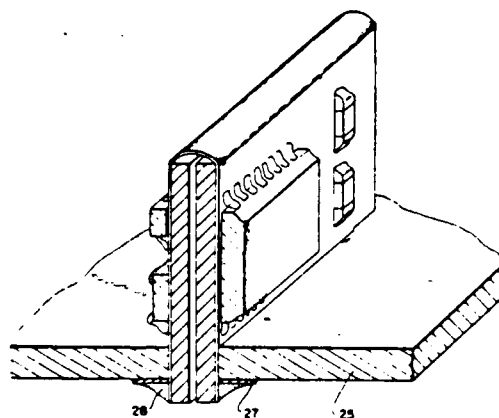
Primary Examiner—R. R. Kucia

Attorney, Agent, or Firm—Wenderoth, Lind & Ponack

[57] ABSTRACT

A hybrid integrated circuit component for insertion in a slit of a mother printed circuit board, and a method of mounting the hybrid integrated circuit component. The circuit component includes a flexible circuit board composed of a flexible insulated substrate, a circuit conductor formed on one side of the substrate, and a pair of conductor layers formed along opposite sides of the substrate to serve as external connection terminals. Circuit elements are mounted on the substrate and electrically connected to the circuit conductor. A pair of hard supporting plates are cemented on the other surface and at the opposite sides of the substrate so that the flexible circuit board can be folded at a center bending portion of the substrate so that the supporting plates face each other and so that the connection terminals are arranged close to each other when the substrate is folded and so that the substrate at its bending portion, when folded, has a sufficient spring characteristic for ensuring contact between the slit of the mother printed circuit board and each of the connection terminals, when the connection terminals are inserted into the slit of the mother printed circuit board.

24 Claims, 11 Drawing Figures



[54] CONNECTION OF LEADLESS INTEGRATED CIRCUIT PACKAGE TO A CIRCUIT BOARD

[75] Inventors: Johannes C. W. Bakermans, Harrisburg, Pa.; Dmitry G. Grabbe, Lisbon Falls, Me.; Iosif Korsunsky, Harrisburg, Pa.

[73] Assignee: AMP Incorporated, Harrisburg, Pa.

[21] Appl. No.: 453,074

[22] Filed: Dec. 27, 1982

[51] Int. Cl.³ H05K 1/18

[52] U.S. Cl. 361/399; 174/52 FP; 174/68.5; 339/17 CF; 361/403

[58] Field of Search 174/68.5, 52 FP; 361/403, 399; 339/17 CF

[56] References Cited

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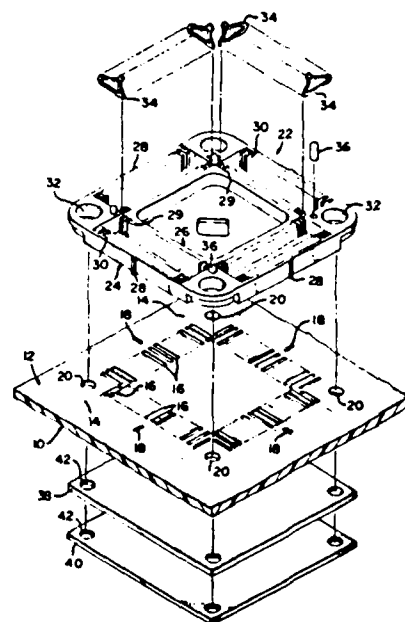
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Primary Examiner—R. R. Kucia
Attorney, Agent, or Firm—Donald M. Boles

[57] ABSTRACT

A device for connecting leadless integrated circuit packages to a chip carrier housing or socket and then to a printed circuit board is taught. Briefly stated, a mask is selectively disposed on a printed circuit board. Locating ribs are correspondingly disposed on a chip carrier housing so as to cooperatively engage the slots created by the absence of the mask on the printed circuit board. Additionally, barriers for separating contacts contained in the chip carrier housing are maintained at the interior and the exterior portion of the chip carrier housing walls with no material disposed therebetween thereby minimizing capacitive as well as inductive effects which may come about. Additionally, four discrete interlocking brackets are disposed on top of the chip carrier housing which allow for complete assembly of the chip carrier to the printed circuit board before mating of an integrated circuit chip with the retaining brackets then interlocked so as to relatively rigidly maintain a chip carrier in electrical contact with the contacts. The present device therefore allows for relatively fast accurate alignment of all attendant contact surfaces.

7 Claims, 5 Drawing Figures



[54] **IMPULSE NOISE REDUCTION BY LINEAR INTERPOLATION HAVING IMMUNITY TO WHITE NOISE**[75] **Inventors:** Yukinobu Ishigaki, Tokyo; Kazutoshi Hirohashi, Yokohama, both of Japan[73] **Assignee:** Victor Company of Japan, Limited, Japan[21] **Appl. No.:** 585,926[22] **Filed:** Mar. 2, 1984[30] **Foreign Application Priority Data**

Mar. 7, 1983 [JP] Japan 58-37130

Mar. 7, 1983 [JP] Japan 58-37131

[51] **Int. Cl.³** H03B 1/04[52] **U.S. Cl.** 328/165; 330/149; 455/223[58] **Field of Search** 330/149; 328/162-165; 455/303, 312, 223, 222; 375/104; 381/94[56] **References Cited****U.S. PATENT DOCUMENTS**

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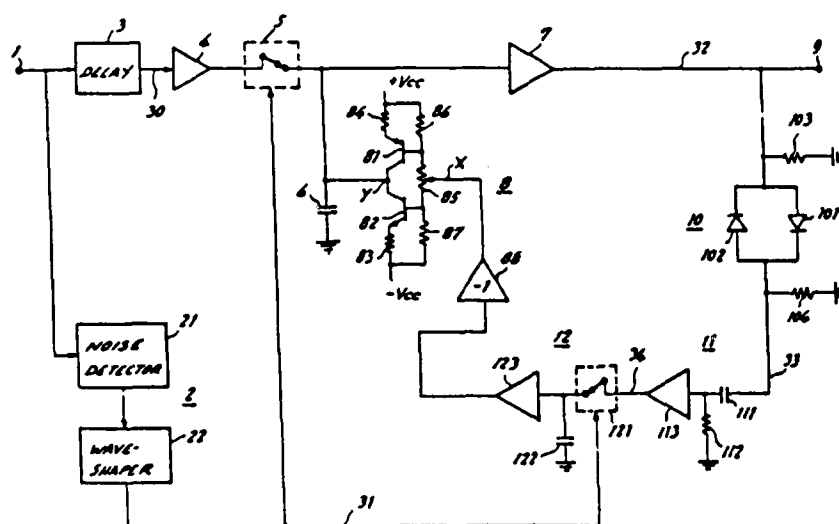
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Primary Examiner—James B. Mullins**Attorney, Agent, or Firm**—Lowe, King, Price & Becker

[57]

ABSTRACT

An analog audio signal is applied to a sampling pulse generator (2) which generates a sampling pulse in response to an impulse noise introduced to the signal and also to a first sample-and-hold circuit (5, 6, 7) which tracks the waveform of the audio signal when impulse noise is nonexistent and holds the signal in the capacitor (6) in response to the sampling pulse. A nonlinear transfer circuit (10) is provided to eliminate white noise contained in the analog signal from the first sample-and-hold circuit and feeds its output to a differentiator (11) to derive a signal representative of the slope ratio of the analog signal. A second sample-and-hold circuit (12) samples the slope ratio signal in response to the sampling pulse and applies the sampled signal to a bidirectional constant current source (8) which provides constant current charging and discharging of the capacitor (6) to linearly vary the voltage sampled by the first sample-and-hold circuit (12).

6 Claims, 6 Drawing Figures

United States Patent [19]

Bednarz et al.

[11] Patent Number: 4,542,076

[45] Date of Patent: Sep. 17, 1985

[54] METALLIZED MOLDED PLASTIC
COMPONENT HOUSINGS FOR SHIELDING
AGAINST ELECTROMAGNETIC
INTERFERENCE FIELDS

[75] Inventors: Jürgen Bednarz, Penzberg; Wolfgang
Lindig, Munich, both of Fed. Rep. of
Germany

[73] Assignee: Siemens Aktiengesellschaft, Berlin &
Munich, Fed. Rep. of Germany

[21] Appl. No.: 544,885

[22] Filed: Oct. 24, 1983

[30] Foreign Application Priority Data

Dec. 27, 1982 [DE] Fed. Rep. of Germany 3248147

[51] Int. Cl.⁴ C23F 1/00; B32B 15/08

[52] U.S. Cl. 428/624; 428/625;
428/626; 428/161; 174/35 R; 315/85; 455/300

[58] Field of Search 428/161, 625, 626, 624

[56] References Cited

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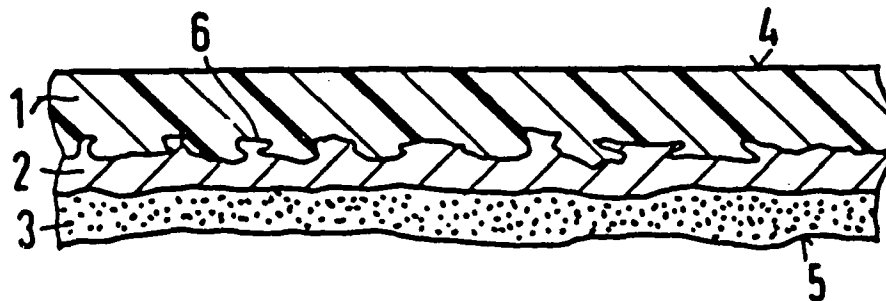
Primary Examiner—Veronica O'Keefe

Attorney, Agent, or Firm—Hill, Van Santen, Steadman &
Simpson

[57] ABSTRACT

The invention relates to molded pieces of plastic having at least a partial metal coating of their surfaces. The surfaces to be coated are roughened up by means of suitable pretreatment so that a good adhesion of the metal coating on the molded pieces is provided. For the support of this metal coating additionally a cover layer is applied. The molded pieces can also consist of shrinkable material which e.g. are also designed in the form of enveloping objects such as cable fittings.

6 Claims, 1 Drawing Figure



[54] SWITCHING FIBER OPTIC AMPLIFIER

[75] Inventors: Herbert J. Shaw, Stanford; Michel J. F. Digonnet, Palo Alto, both of Calif.

[73] Assignee: The Board of Trustees of Leland Stanford Junior University, Stanford, Calif.

[21] Appl. No.: 531,231

[22] Filed: Sep. 12, 1983

[51] Int. Cl.⁴ H01S 3/094; H03F 3/68

[52] U.S. Cl. 330/4.3; 330/4; 330/84; 330/85; 330/122; 372/6; 372/71

[58] Field of Search 330/4.3, 4, 84, 5, 122, 330/147.8; 372/6, 71; 455/607; 350/96.15; 332/7.51

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List continued on next page.

Primary Examiner—S. C. Buczinski

Assistant Examiner—Burton J. Carniol

Attorney, Agent, or Firm—Knobbe, Martens, Olson & Bear

[57]

ABSTRACT

A fiber optic amplifier utilizes a crystal fiber of laser material to bidirectionally amplify light signals. This amplifier permits the application of both pumping illumination and the signal to be amplified to the end of the crystal fiber to avoid the disadvantages inherent in side pumping this fiber. End pumping is accomplished by taking advantage of the slow spontaneous fluorescence of the laser crystal to sequentially apply the pumping illumination and then the signal to be amplified to the crystal. This sequential application of signals is made possible through the use of a switchable coupler which allows light to be selectively coupled from either of a pair of input optical fibers to a single output optical fiber which is coupled to the crystal fiber. The pumping illumination is initially supplied to the crystal fiber to invert the ions within the crystal. Once these ions are inverted, the coupler is switched to permit the application of the signal to be amplified to the crystal, and the application of pumping illumination is temporarily discontinued. The signal to be amplified propagates through the crystal to stimulate emission of coherent light from the laser material resulting in amplification of the signal. When this amplification process is complete, pumping illumination is again applied through the switch to the crystal fiber.

18 Claims, 11 Drawing Figures